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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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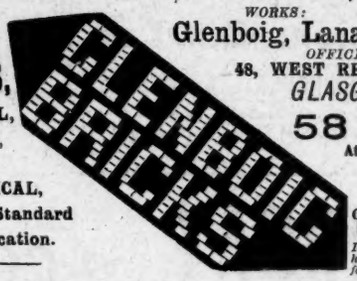

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VOL. CLVII., No. 3070.] WEDNESDAY, MARCH 15, 1922. [74TH YEAR.

EDITORIAL NOTES.

Slow Recession from Hardships, and Other Matters.

WHEN the accounts of gas undertakings are examined in detail or by the sums of expenditure and of dividend in relation to business done now and in the year anteceding the war, it is seen that recession from the peaks of expenditure and (in some instances) from the deep valleys in dividend payments is a slow process. Over this there is obvious disappointment on the part of Mr. W. H. Adams, of Bilston, who, in his Presidential Address to the Midland Association of Gas Engineers and Managers last Thursday, reflected in this particular the views and feelings of many managers of gas undertakings. Every gas management feels acutely the accumulation of financial burdens, which show less disposition to contract than they did to grow in girth. The crushing burden of taxation especially weighs with Mr. Adams, as it does with all concerned in industry and business, and indeed with all individuals who have to pay rates and taxes. But when the President contrasts pre-war figures with those obtaining now, there is natural indignation on his part. In 1913 his Company paid in rates and taxes £1200, and in dividends, free of tax, £5375. Now the amount paid in rates and taxes—being £5890—exceeds the sum of the dividends paid in 1913; while the amount that can at present be paid in dividends is less than half what it was in 1913—being now £2600. Thus the increase in the rates and taxes is £4690, or about 390 p.ct. This sort of thing makes one wonder whether those who are responsible have any conscience, business ability, or vision to enable them to see that this condition effectually retards progress and restoration of those circumstances that enable a country to climb to greater heights in prosperity. Present rates and taxes are in part chargeable with that unemployment which in turn increases the rates, and induces local authorities to launch-out on to expenditure in relief work which is largely unremunerative, and the material value of which generally falls far short of the outlay incurred.

There is, so far as gas stocks and shares are concerned, a secondary effect from the inability to comply with current ideas as to dividends or, in the case of many concerns, to pay pre-war rates of dividend. In companies which have obtained some relief, and are able to pay approximately pre-war dividends, there has been a good, though partial, recovery in market values; but in concerns circumstanced as is that at Bilston, the capital holdings have been reduced in value to practically one-half what they were. Undertakings in such case want capital, but cannot obtain it on reasonable terms. This is retarding business development. They cannot conveniently or economically reconstruct or extend, nor can they restore simple hire schemes for gas apparatus. The valuable privileges conferred by the Gas Regulation Act are acknowledged in the address; but for the Bilston Gas Company and its like, the confidence of investors will only be restored as pre-war dividends are again received, and received with a lighter encumbrance of income-tax. The Gas Regulation Act is powerful within limits; but there are many things with which it cannot deal. One of them is this load of rates and taxes about which Mr. Adams justly complains, and in respect of the reduction of which he is fully persuaded public bodies are not doing all they might by economy and the cutting-down of expenditure. The Geddes reports have been valuable in the matter of national expenditure. They are in effect a condemnation of extravagance. It would not be amiss if every town had a competent Committee to investigate local finances, and to report as to where the "axe" could be conveniently or reasonably applied.

We pass on to coal. There too the President finds firm ground for discontent. There has been talk of a decrease of £1 below pre-strike prices; but, as a matter of fact, the price has only been reduced by about 12s. There does not appear to be any prospect of an immediate (we will go no farther than that) further lowering of price, in view of the growth of the export gas coal business, particularly in the better sorts. The disposition of the coalowners is to sit tight at present levels; the disposition of gas undertakings, unless more favourable prices are forthcoming, will be to make short-term contracts, and to buy here and there as opportunity presents itself for making a bargain. Gas undertakings are in a stronger position now in respect of stocks; and, with the mining industry clear of heavy clouds, there is likely to be a large amount of buying from hand to mouth. Had prices descended somewhat more, there would have been a greater willingness to consider and enter into contracts of the old normal length; but uncertainty creates hesitancy and unwillingness to commit oneself. Other cognate matters receive consideration in the address. It is acknowledged that the quality of coal is improving; but there is much to be done yet to cause the coal to reach its pre-strike standards in this respect. In this matter we must give the coalowners their due. They have done much in their insistence upon reversion from shovel to fork filling to produce cleaner coal. Then there are railway rates for the carriage of coal. The reduction of these have been somewhat slight; and the President says that there has been no concession in the rates on the coal from Yorkshire. The smallness of the concession where it has obtained has been the subject of attack by industries throughout the country; and here, again, the coalowners, through their representative organization, have been prosecuting with ardour the claims not only of their own but of industry generally to a more liberal consideration in this respect. On the other hand, Mr. Adams seeks a concession from the colliery proprietors and coal merchants in respect of the hire of their wagons, the rates for which he holds should be reduced to the levels of those of the railway companies. It is all these and other items of excess cost that, in the aggregate, bear so heavily upon an industry such as that of gas supply, with so much financial control about it. It is all reflected in the price of gas; and undertakings with limited resources and business area suffer most—undertakings, many of them, with good reputations for cheap gas before the war.

There is good ground for indignation over these matters. But while seeking to obtain alleviation, the responsibility is upon engineers and managers to do all they can to produce economy in the circumstances of conditions and environment. In the case of Bilston, the Company are proposing to declare a calorific value of 450 B.Th.U., as the most suitable having regard to their plant and the requirements of the district. One of the industrial needs of the district is coke, and that need Mr. Adams says his Company intend to continue to satisfy, and so live up to the title of the "Bilston Gas Light and Coke Company." Incidentally, we may express the hope that they will live beyond it, and will some day drop the "Light" out of their cognomen. These points are made because the President, taking complete gasification as the ultimate state of gas production, is of opinion that policy in respect of production and other things must be considered in relation to the individual circumstances of every gas undertaking. That is true. No specification of policy can be drawn up that will apply universally. There are in the address interesting references to subsidence and naphthalene experiences, as well as to the

Venturi meter, of which the President has had some years' experience. He sees signs of greater peace in the labour world—of a recognition that there are two sides to all these questions that have hitherto disrupted the relationships between two essentials to industry, capital and labour, which should be synthetized and made permanently inseparable. There is trouble in the engineering world at the moment of writing, but it is hoped that it will be short-lived. He sees also the lifting of the cloud of trade depression. These are matters which viewed in the whole make one look forward with more cheerfulness than was the case twelve months ago.

Assessments of Gas Undertakings.

The question of rates and taxes is a very difficult one. When this is said, it sums-up the position neatly and concisely; but it does not get rid of its organic complexities and official divergence in procedure practices. Rates and taxes are bearing particularly heavily on gas undertakings at the present time; and therefore it is not surprising that two Presidents of district gas organizations should, within a few days of each other, be referring to the matter. We had last week comment and suggestion relating to the subject in the Presidential Address of Mr. Harold Davies to the Manchester Institution. We find again allusion to it in that of Mr. W. H. Adams, to the Midland Association, as mentioned in the preceding article. There are in this connection two or three points in the remarks of Mr. Davies which invite comment. It will be remembered that he said that, in looking over the published returns of a large number of companies, one finds an amazing variation in the amounts per 1000 c.ft. called for by rates and taxes. Whether this is accounted for by the bulking of the two items, he was not in a position to state. Then came the suggestion to the compilers of returns that in future rateable values and the rates paid might with great advantage be separately ascertained and included in the published tables. This information Mr. Davies thinks would be of great advantage when the time arrives for the gas industry to push forward a scheme for the more equitable assessment of its undertakings. He also asserted that the hypothetical tenant has been dead for the past few years, or ought to have been, and that the time is opportune for the birth of a new standard in this direction. Attention was also called by him to the marked variation in procedure in respect of the handling of assessments by Assessment Committees and their officials. Assessment for income-tax purposes was also described as a complex problem. That is a *résumé* of what Mr. Davies had to say upon the subject.

Now first as to the assumption that the hypothetical tenant is dead, or, if not, that he ought to be. This is a matter that is open to a difference of opinion. When it is realized that assessments generally are more or less based upon rent, it follows that an attempt must be made to arrive at the value of an undertaking for rent purposes through the medium of a possible tenant. If any method other than the one in common practice were adopted, it might end in precisely the same result, or probably in a worse one. No one can say. It is very difficult to anticipate that, by merely adopting another system, the much-desired relief will be forthcoming.

Then as to the differences that exist between assessments, these, of course, depend to a large extent upon local and other incomparable circumstances. Some authorities have a preference for assessing on a higher basis than others in order to be able to charge a lower rate. Other authorities are content to leave an undertaking undisturbed over rating for quite a number of years; while others are just the reverse. Large companies like those in the Metropolitan area have experiences of all kinds. Although a valuation of any one of these companies may be arrived at by the accepted method, it is very difficult to get any two authorities to agree to the same percentage—for instance, upon direct mains—unless they happen to employ the same valuer. Again, one district may contain mains (both direct and indirect) and works, while another district may contain works only; and so the assessment agreed upon in each case will bear no resemblance whatever. The only way in which such difficulties could be overcome would be to have a Central Assessment Committee; but this innovation could, we should imagine, not be accomplished without a good deal of political disturbance.

Coming to the proposal that the rateable value and the average rate paid in the pound should be shown in statistical records, further consideration of the point, in conjunction with the reasons already advanced, leads to the conclusion that no useful purpose would be served by the inclusion of such figures. The expenditure on rates and taxes is always treated as a separate item; and the cost per 1000 c.ft. or per therm forms a criterion of the incidence of this particular charge as between undertakings. Income-tax is, as a rule, included in the amount shown under rates and taxes, and would have to be separated if the figure only for rates was required. Admittedly the question of income-tax assessment is a difficult one; and very little inference can be gathered by comparing the various charges, as the figures depend in the first place upon profits made in a preceding year, and, secondly, upon the amount distributed in the shape of dividends and interest during another period. If rating or income-tax assessments were always based upon some simple and relative factor, there would perhaps be some use in giving detailed comparative figures; but the whole question is such a varied and complex one at present, that very little advantage would be gained (so we think) by giving any extended information in statistical returns.

Prices of Gas and Gas Appliances.

On several occasions emphasis has been laid in these columns upon the fact that the interests of the gas-supply industry and of the industries making gas appliances are mutual—in other words, the prosperity or otherwise of the one is reflected in the prosperity of the other. There is, however, a disposition in some places in the gas-supply industry to think that this state of reciprocal interests is not always sufficiently recognized by the manufacturers of gas appliances, and they point (with assurance unsupported by positive facts) in proof of this to the prices of gas appliances. But, on the other hand, the makers of gas appliances could well and justly submit that the current prices of gas constitute one of the causes that prevent them attaining the maximum efficiency and economy in their works, by retarding that demand for goods which would enable them to enlarge production, and so obtain for the gas industry any advantage in price that can be secured therefrom. There are matters in this connection over which one cannot generalize. The price of gas is high. In some cases, it may be higher than there is any occasion for; but, generally speaking, it is not higher than is warranted in the circumstances of high cost of coal, labour, rates and taxes, and other outgoings, together with the low values of secondary products. The manufacturers of gas appliances realize and acknowledge this. They are sorry for the gas industry in respect of their disabilities in this matter of moving faster in lowering their therm prices. And naturally part of the regret arises from the fact that they themselves are handicapped in production through the retarding of demand for their wares, owing to the cost of the essential fuel. What is realized and felt by the manufacturers was well expressed by Mr. H. James Yates in his address to the shareholders at the annual meeting of Radiation, Ltd. There was the disastrous coal strike of the past year; and Mr. Yates pointed out how it had adversely affected the manufacturers of gas appliances by interfering with, and adding enormously to the cost of, manufacturing gas, so delaying reductions in its price. Everything that has been a hindrance to the gas industry has been the same to the manufacturers of gas appliances. That is a point which should not be overlooked in those quarters of the gas-supply industry in which there is a proneness to make allegations which it is very difficult to justify by fact.

The acknowledgment of the gas-supply industry's difficulties was made at the beginning of the address. The reference to the prices of the makers' goods was included towards the end; and there was a lot that was philosophic on economic and labour problems between, and with which we are much and generally in accord. Without going into works costs records (which are always there to supply evidence as to justification), one can sometimes institute a test by comparison, though admittedly not of a very positive nature. Still there is some measure of merit in not having gone along the road of high charges to the same extent as others have done. Mr. Yates says he is satisfied that, if all the advances made by manufacturers in other trades since the war began were to be carefully reviewed, it would be seen that the gas-stove makers had not advanced their prices to nearly the same degree as most other manufacturers. Also they delayed raising prices at the outbreak of the war;

when they did raise them, they were long overdue. In view of this, it is not possible for them to make price reductions on the same basis as manufacturers of some other goods used in the industry. We have no interest in defending the manufacturers; we have an interest in being just, and to examine neutrally and intelligently these matters as they are presented to us. And we do so with other evidence before us than that which is found in the illuminating address published in our news columns to-day. Mr. Yates speaks comparatively in respect of other manufacturers. Men of the gas-supply industry who are prone to criticize and condemn should compare the advances of the gas-stove makers with the advances in the price of gas, and ask themselves what is different in their position from that of the gas-stove makers. Did the prices of raw material of all kinds go up for them as for the gas industry? Did the price of labour rise equally? Did the men in their case think that less hours and work and so less man-output and yet more money were beneficial for permanent adoption —thus again adding to the cost of production? Have the manufacturers of gas-stoves any secondary products resulting from the use of their principal raw materials the revenue from which would reduce the net cost of those materials? Have rates and taxes and other charges gone up for them as for the gas-supply industry? Liberal-minded consideration should be given these matters, and judgment should be not by surmise but on investigation. Materials, labour, and the other things, are not the only charges. All expenditure—rates, taxes, and everything else—has gone up for them as for the gas industry. Moreover, for such work a great deal of expenditure has to be incurred in the quest for improvement in design and efficiency. In fairness, all these matters should be taken into consideration.

This brief reference to the address may be concluded by saying that we should like to see the spirit which permeates the following words animating all the men of the gas industry: "I desire to express my conviction that it is not "merely desirable but essential that there should be hearty "co-operation among all the interests which form the gas "industry. I regard this co-operation as the key to the "success of that industry." So do we; and we have always done so.

District Conferences of the "B.C.G.A."

THANKS to the Chairman and Directors of the Southampton Gas and Coke Company, and their energetic General Manager and Secretary (Mr. J. R. H. Jacobs), a good lead was given on Tuesday of last week to the District Conferences of the British Commercial Gas Association. In the distribution of information among the public and gas sales staffs, such conferences, in our opinion, do as much good as, if not more good than, the larger, more pretentious, and far more costly annual conferences, which are attended in the main by gas administrators and chief gas officials, who, without any disrespect—essential as they are to the Association—are not the people to whom the work of the organization is directed, or whom it is desired to reach from either the gas popularization or the educational points of view. The District Conferences have, it always seems to us, a closer coincidence with the real objects of the organization. It will be seen from our report of the Southampton conference that several representatives of the public were present, as well as a large number of the employees of the Gas Company. We should, however, have been glad to have heard that the sales employees of several gas undertakings operating in the district were present. There was much in the proceedings that would have been very valuable to them. The papers by Mr. Jacobs and Mr. Sandeman, as our report indicates, contained much information that will be useful for propaganda work. There are in them actual experiences and material facts of which sales staffs as well as the public should be acquainted; and there was the salesman's exhibition which no doubt contained considerable suggestive nuclei, which those concerned in gas sales could develop. There is no question about it that there is in the industry room for a more intensive sales-developing campaign. Trade depression and the remnants of adverse circumstances are in some places being made the excuse for still not doing more in pushing business. There are no definite limits to the field that lies before the industry. It grows larger and larger with the extension of knowledge as to what can be done by gas; and every fresh development gives birth to a still greater view. Indeed, there is something almost infinite about the possibilities. But the task of development must be faced boldly. The electricians are not allowing current circumstances to hinder them in attempting to effect sales expansion; and yet they have more obstacles to development than has the gas industry. The District Conferences will, we think, help to stimulate activity in business-getting. The newly organized distribution stores of the Southampton Gas Company were one of the interesting features for those attending the Southampton conference. These have been modelled on the system recommended by the British Commercial Gas Association; and the results are economy in time, materials, labour, and money, and the promotion of efficiency.

Utilizing Waste Oil-Gas Hydrocarbon.

IN gas-works very little oil-gas proper is now made; but a large amount of gas oil is used for carburetting water gas—not so much as formerly per 1000 c.ft., but still a large quantity in the aggregate. Through this, there is association with the work that is done by oil-gas technologists; and so we think gas-works chemists will be interested in an article contributed to this week's issue of the "JOURNAL" by Messrs. A. G. Burnell and R. W. Dawe, which describes the patient laboratory investigation that led up to their patented process for manufacturing motor spirit from the highly volatile liquid which is deposited in compressed oil-gas storage tanks. In industrial operations, there are often residual products which are wastefully utilized, and with which something better might be done. In this particular case, every 1000 c.ft. of oil gas made deposits 1 gallon of hydrocarbon liquid in the tanks into which it is compressed at a pressure of 150 lbs. per square inch, which shows that even a small plant of 20,000 c.ft. production a day would yield about 140 gallons of crude hydrocarbon liquid every week. This residual contains a high percentage of benzole and its homologues; and it is therefore wasteful to burn it as a fuel for steam-raising. Unfortunately, the valuable constituents are associated with several other compounds which render the former unsuitable for many purposes. The problem the authors of the article have been tackling is how to obtain motor spirit from the refuse substance without its being vitiated by the deleterious compounds. A large range of experiments was carried out in the laboratory; and eventually a process was developed which requires quite a simple plant. The character of the work done and the results achieved are explained in the article. A really good motor spirit results, as motor car trials have proved. The quantity of motor spirit varies with the nature of the crude hydrocarbon, which is largely dependent on such factors as the quality of the gas oil, retort temperatures, and degree of compression. In the process a quantity of gas is liberated from the crude spirit, which the authors suggest could be used for enriching coal or water gas or producer gas where these or any of them are made on the same premises. As we have remarked, gas chemists who have to deal with gas oils will be particularly interested in the suggestive work described; and so will be our readers who are officially concerned in the gas-making practices of our railways.

Gas Prices.

In most places the directors of gas undertakings are persuaded that the price of gas is too high; and they are considering and discussing the prospects of further reductions. The enabling power to do this is a slow growth; but still, hopes are fairly prevalent that this year will see in many cases one reduction, if not two, per therm. Among those who are quite hopeful of this is Mr. H. E. Jones, the Chairman of the Wandsworth, Wimbledon, and Epsom District Gas Company. That Company at one time boasted the lowest-priced gas in the Metropolitan area. They can no longer do so. On the therm basis a smaller Company boast a lower price, though with less favourable coal transmission and reception facilities. But Mr. Jones wants no such spur as this to make him seek to restore his Company to the premier position in and about London in respect of charges to consumers. The Hornsey 11d. and the South Metropolitan 11½d. per therm are up against him at present. But his remarks on the subject at the meeting of the shareholders of his Company showed that he is not going finally to relinquish what he once held without a bold struggle to regain it.

Chemical and Physical Properties of Refractories.

Juniors in the gas profession—and for the matter of that seniors too—who desire to enter upon the study of the chemistry

and physics of gas-works refractories cannot do better than thoroughly digest the lecture that Mr. T. F. E. Rhead, M.Sc., Chief Chemist of the Birmingham Gas Department, delivered to the Midland Junior Gas Association last Thursday. When the contents of the lecture are mastered (it is reproduced in later columns), students will find that interest in the subject will develop at a remarkable rate. It is not a lecture upon which comment can be usefully made. It is wholly a statement of facts, presented in the plainest possible way.

Gas Coal Position.

Last week there was only one quarter of the coal areas where there was any real firmness in respect of gas-making coals. That was in the Durham and Northumberland fields, where the conditions in respect of transactions for export are altogether different from all other areas. Just previously there was a disposition to general firmness in most areas; but there appears to be a sharp divergence of opinion as between sellers and buyers as to prices. Even in Yorkshire last week there was less activity; and some gas undertakings were able to buy in the open market at below colliery quotations. Open-market buying of gas coals has been going on in North Wales; the general demand having fallen considerably. In Derbyshire, Scotland, and other quarters, much the same condition of inactivity prevails.

The Engineering Stoppage.

The negotiations in the attempt to prevent the lock-out in the engineering industry proved abortive last week, and the stoppage commenced on Saturday. The men directly affected are the members of the Amalgamated Engineers' Union; and the number is reported to be somewhere about 300,000. It is, however, computed that round about a million men will, as a consesequence, be thrown idle. The employers are making a stand for an important principle. The issue is a refusal by the trade unions to continue the recognition of an employer's right to exercise managerial functions in his establishment, unless with the consent and approval of the Union, which must be obtained prior to the initiation of any managerial act to which the Union might feel inclined to take exception. On the other hand, the Union assert that their grievance is based on the question of overtime. They say that the employers are claiming the right not only to employ men on overtime, but also to engage unskilled men on skilled work, without consultation with the Union representatives. The public will not be so simple as to believe that the employers will put men on skilled work who are not qualified for it. It is well known that interference with managerial functions has been growing in the engineering industry to an extent that cannot be longer tolerated. However, the stoppage is a deplorable thing—particularly at this time—in fact, it is a calamity of the first magnitude for the country. However, the sooner the Union are shown that their functions cannot be permitted to extend so far, the better it will be for all concerned. Writes one labour authority: "The workers have much to lose, and nothing to gain from this fight." That is about the truth of the matter.

Summer Time.

The House of Lords has given second reading to the Bill to make "summer time" a permanent institution. If the measure becomes an Act, the clock will be put back by an hour on the last Saturday in March, or, when that Saturday immediately precedes Easter, on the last Saturday but one in March, and end on the first Saturday in October. The French Chamber appears to be rather sharply divided over the question of giving permanence to "summer time." The plan was entered into in agreement with this country and Belgium. But when the French Bill was introduced the other day it was in the first place rejected. Wiser counsels subsequently prevailed; and the Bill was passed in an amended form, so that, for this year at any rate, the change will coincide with that in this country.

Home Oil Production.

We rather incline to think that the Government have had enough direct participation in the exploration for natural oil in this country. What has so far been done has not been encouraging; and so, it seems, they are prepared to leave future work in this line practically to the unfettered discretion of private enterprise. Mr. Bridgeman has announced in the House of Commons the new version of Government policy in the matter. There is to be no further question of Government royalties. The man who seeks to develop home oil supplies and the landowner upon whose land he operates will make their own arrangements. The only control the Government will exercise will be to prevent indiscriminate drilling; and for this purpose the Petroleum Department will continue to grant licences over certain areas. But the Government have finally abandoned their intention of introducing legislation to give the Crown any further rights or powers in respect of petroleum other than is already possessed under the Petroleum Production Act. The "Petroleum Times" regards Mr. Bridgeman's announcement as "highly important;" our contemporary having all along contended that there is petroliferous wealth in plenty beneath the soil of Great Britain. Our assessment of the evidence available so far is that it is not of a character to excite optimism of the first grade.

Pit and District Coal Committees.

Both Houses of Parliament have refused to agree to motions that Part II. of the Mining Industry Act shall not cease to have effect. The result is that the provision for setting-up compulsorily pit and district committees goes by the board, and now the system of voluntary committees will have to be followed where it is desired to have means of conference between management and workers. The voluntary system is applied in several pits, and is working well. Originally, the miners opposed Part II. Now they want it; and the owners do not. The feeling of the Government is that Part II. is desirable; but from the time it was originally before Parliament, they have taken the view that, if both sides would not accept it, then voluntary arrangements would be the only possible practicable course. This leaves the mining industry in practically the same position as other industries.

PERSONAL.

Mr. A. A. Johnston, J.P., Engineer and Manager of the Brentford Gas Company, was returned at the top of the poll for the Middlesex County Council (Brentford East Ward).

Mr. H. A. Rutherford has been appointed Manager to the Keith Gas Light Company. He is at present Manager at Inverkeithing.

Mr. Jas. Blocker has been appointed Manager at the works of the Aberfeldy Gas Light Company.

Mr. Frank Livesey, B.A. (Cantab), Engineer to the Maidstone Gas Company, has been transferred from the class of associate member to that of member of the Institution of Civil Engineers.

Mr. Sam Ogden, Clerk to the Hebden Bridge Urban District Council, has been appointed Clerk to the Hebden Bridge and Mytholmroyd Gas Board, in succession to Mr. Richard Crabtree.

The duties of the office of Secretary of the Midland Junior Gas Association have been taken over by Mr. H. R. Hems, Industrial Research Laboratory, Gas Department, Birmingham, in consequence of Mr. B. J. Bell's having taken an appointment with the Cardiff Gas Company.

Mr. E. H. Swain, whose appointment as Gas Engineer to the Morecambe Corporation was notified in the "Journal" a fortnight ago, has since been induced to remain in his present position as Engineering Assistant to the Gas Referees.

OBITUARY.

The death occurred on Tuesday of last week of Mr. William Harvey Whiston, a Director of the Derby Gas Company. The deceased gentleman, who was in his 80th year, was Clerk to the Derby Borough and County Bench for 44 years. He was also the County Coroner and the Clerk to the Repton Magistrates.

Silica Bricks for American Coke-Ovens.—Mr. J. W. Lee, of the Hasland Coking Company, at a meeting of the Midland Section of the Coke Oven Managers' Association, said that one of the special features of American coking practice was the use of silica bricks. In no modern plant was anything else but silica brick used in the construction of the oven. The expansion in a 40-ft. length was about 5 inches. The bricks were usually made from material containing 97 p.ct. of silica. It was undoubtedly possible to shut-down ovens built of silica brick without doing more damage than would be done to the ordinary firebrick ovens as constructed in this country. He saw one battery which had been shut-down fifteen times in five years, and had not been re-built or re-lined during this time. Of course, nobody wanted to shut-down at all; but silica-brick ovens could be shut-down if absolutely necessary.

ELECTRICITY SUPPLY MEMORANDA.

The Electricity Supply Bill which Viscount Peel introduced in the House of Lords has been published. It is mainly a financial measure, designed for the purpose of giving Joint Electricity Authorities the necessary money-raising powers if they are to go on with the schemes of electricity generating reorganization and concentration. At the moment, they are impotent, in view of their inability to raise money. The first clause gives the power to borrow, subject to the consent of the Electricity Commissioners and to regulations made by the Minister of Transport, with the approval of the Treasury. The regulations will make provision as to repayment of loans, or reborrowing for the purpose of paying-off a loan previously raised. They will also empower an authority to borrow temporarily, to issue bonds, and to make arrangements with bankers. The powers of borrowing may be exercised for the purposes of the payment of the purchase price of any generating station or transmission line, or for part of an undertaking acquired by an authority under the principal Act, or for constructing new works, and providing working capital. Any money borrowed is to be a charge on the undertaking and revenues of the authority, and is to be repaid within a period to be determined by the Electricity Commissioners. Provision is made for the suspension of repayment for a period not exceeding five years in respect of expenditure on new works which have not become remunerative. To enable the Joint Authority to raise money, the issue of stock is also authorized, to bear interest at such rate as the authority, with the consent of the Commissioners, may determine. Only with the sanction of the authorized undertakers concerned, a Joint Electricity Authority may discharge the whole or any part of the purchase price payable for any generating station or transmission line by the issue of stock or other securities as may be agreed upon.

The New Bill.

The Bill is described as non-contentious; but the very next clause contains a provision to which on previous occasions financial and industrial magnates have raised strong objection. It empowers any authorized suppliers within the area of a joint electricity authority to lend money to that body for which borrowing powers exist, or to subscribe for any securities issued by a joint electricity authority for the purpose of raising such money; to guarantee or join in guaranteeing the payment of interest on any money borrowed by the joint electricity authority, or on any securities issued by that authority; or to give financial assistance in any other form to the joint electricity authority. This assistance is to be on such terms (including the payment of consideration for the assistance given), and subject to such conditions, as the authority, company, or person rendering such financial help may think fit. In the case of the council of a county or borough or county district, these powers are not to be exercised (except by the London County Council) without the consent of the Minister of Health. There we have repeated one of the grounds of objection and controversy when the No. 2 Electricity Supply Bill was before Parliament. Large ratepayers have a strong antipathy to local authorities becoming lenders as well as borrowers, and to them guaranteeing the payment of interest on money borrowed by a body over which they have no or little control—being only a constituent part of it, or perhaps not a part of it at all. We shall not be surprised if this condition provokes a large amount of controversy both inside and outside Parliament.

Financial Assistance by Local Authorities.

A clause deals with the expenses of the Electricity Commissioners, and for their apportionment among the Joint Electricity Authorities and authorized undertakers. The apportionment is to be made on the basis of the number of units generated by each electricity authority or authorized undertaker. Following on a number of miscellaneous powers, there is a clause dealing with the limitation of prices charged. It provides that "the prices charged for electricity by a joint electricity authority shall be so fixed by the authority, subject to such directions as may be given by the Electricity Commissioners, that, over a term of years to be approved by the Electricity Commissioners, their receipts on income account shall be sufficient to cover their expenditure on income account (including interest and sinking-fund charges), with such margin as the Electricity Commissioners may allow." Three years is to be made the period for the revision of prices and methods of charging by authorized electricity suppliers. The contemplated powers are such that any form of tariff can be authorized, including the bi-part one—such as a lump payment and a small charge per unit for all energy consumed. It is next proposed that authorization shall be given to the owners of any railway generating station, or of any generating station erected under statutory authority for the purpose of working tramways, to supply electricity to a joint electricity authority, or, with the consent of the joint electricity authority, to an authorized undertaker whose area of supply is situate within the district of a joint authority, to an authorized undertaker whose undertaking is not in the district of a joint electricity authority, or "to any consumer, subject, in the case of premises situate within the area of supply of an authorized undertaker, to the consent of that undertaker." The consent of the Electricity Commissioners is also to be obtained. No supply is to be given to any authorized distributors whose undertaking is in the area of a power company without the consent of the company; and no such supply is to be given to any premises within the district of a joint electricity authority, and not within the area of any other authorized undertakers, without the consent of the authority. It is further proposed that, in the application of Section 1 of the Electric Lighting (Scotland) Act, 1902, for money borrowed after the passing of the present measure, a period not exceeding sixty years is to be substituted for a period not exceeding thirty years, as the period within which money borrowed by a local authority within the meaning of the schedule to the Electric Lighting (Scotland) Act, 1890, is to be repaid. This is a review of the principal parts of the Bill.

Revenue, Charges, and Other Matters.

The alleged "non-controversial" nature of the Bill had a heavy blow on Monday of last week when up for second reading in the House of Lords; for one noble Lord after another showed that there is a great deal that is polemical about the measure. There is little that is new in the arguments for the Bill; the strongest point, of course, was that the joint authorities could not proceed, and their schemes could not be brought to fruition, owing to the disability under which they labour. Nothing appears to have been said as to the great dissension there is among local authorities regarding the need for these bodies and their works. But from the side of the opposition, it was pointed out that no single scheme that had been formulated by the Electricity Commissioners met with the unanimous approval of the electricity undertakings concerned. It was also contended that, if local authorities are to be empowered to lend money to the joint authorities, there should be a limit imposed. It was freely suggested that there would be no effective control over the proceedings of the joint authorities, and that charges would go up, instead of descend, and that rates would accompany them. This is a pretty black prediction for the ratepayers, whose burdens are already of a grievous character. Industrial depression was also put forward as a good reason for not going forward with the Bill or the schemes. In other words, this is not the time to indulge in uncertainties. The strength of the opposition is shown by the fact that there voted for a second reading only 59 members, while 40 registered votes against it—a majority for the Bill of only 19.

Strong Opposition in the Lords.

A very pertinent question was asked at the recent meeting of the London Electric Supply Corporation by the Chairman (Mr. R. H. Benson). He was speaking of the height of local rates; and he said that when complaint was made that private enterprise blocked the way to cheap power, the public should remember, among other factors, the increase of rates. In their own case in 1921 the amount paid was £48,400, compared with £11,845 in 1914. This is an increase of 308 p.ct. Then the question: "Should not local authorities expend their utmost energies in trying to give ratepayers some relief before attempting to take on their shoulders the provision of electricity at the risk of still further increasing the rates?" Of course they should. But there are some authorities who do not seem to care a rap about the ratepayers, and conduct their electricity undertakings in a way that cannot fail to make the electricity concern a burden on the ratepayers generally, so that all who are not consumers of current are made to pay part of the costs of supplying those who are. We see, for example, that during the past few years the accounts of the West Ham Electricity Department have shown deficits, which have had to be made up out of the rates. This simply means that insufficient has been charged for the current to produce adequate revenue to ensure that the undertaking shall pay its way. Now the price of coal has been reduced by 40 p.ct.; and there is the prospect of new plant being put into operation shortly. The Engineer (Mr. F. W. Purse) therefore thinks he is justified in recommending reductions in the charges of 1d. per unit to ordinary consumers, and 15 p.ct. to consumers with agreements for supply. Looking away north at Hull, the electricity undertaking made a deficit of £16,000 on the past year's working. This seems to be due to a combination of circumstances—in fact, altogether things appear to have got into an unpleasant muddle there. The plant particularly is inefficient; and there are other conditions that do not make for the smooth working of the department. But it is also alleged that the charges for electricity were not advanced sufficiently to cover the increasing cost of supply. Why was this? In the case of a company, they would have been, or the company itself would have had to bear the deficit. We cannot help thinking that to conduct municipal electricity undertakings at a loss, and then to place the burden on the ratepayers generally, is absolutely dishonest, and never more so than in these times of high rates.

Rates Increase through Price Deficiency.

The Glasgow Corporation Electricity Committee have opened two houses with the view of encouraging the use of electrical appliances. The "Electrical Review" has an article upon them, the chief characteristics of which are that it is very general in its statements, very indefinite, and omits much that one would

All-Electric Houses.

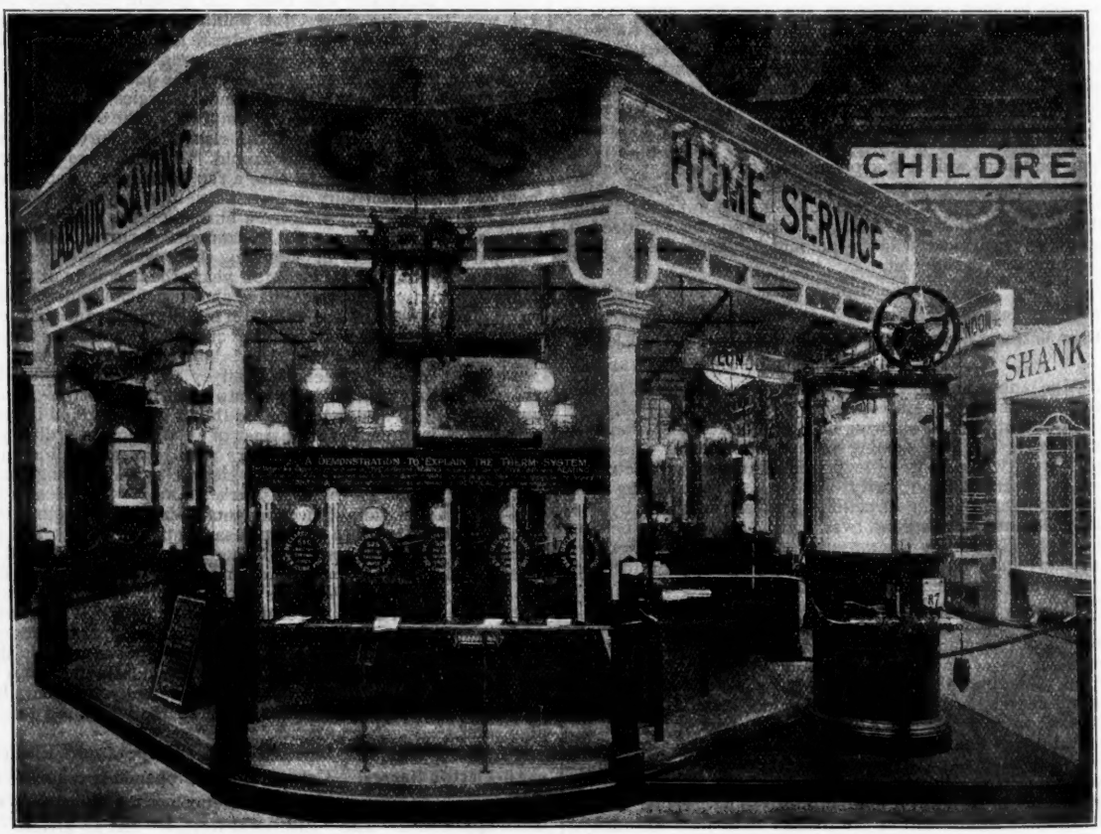
like to know. It is hoped by our contemporary that the experiment will aid in convincing visitors that the "judicious" use of electrical apparatus is the obvious means of reducing housework to a minimum; but some people will find that the reduction of housework to a minimum by the assistance of electricity will cost more than they can afford. There is a point at which labour-saving becomes expensive. It is stated that fireplaces, flues, and chimney heads have been omitted from the houses, so effecting a saving of £40. That is good, but it is no better than can be done with gas. One of the houses is completely equipped for lighting, heating, cooking, hot-water supply, and washing by electricity. The tenant of any house so equipped has our unqualified sympathy. In the second house, however, an open coal fire grate has been installed to meet the double purpose of heating the room and providing hot water—a boiler behind the grate supplying the hot water needed in the scullery and the bath-room. This indicates the uncertainty that exists regarding the popularity of the first equipped house when it has had an opportunity of showing its purse-lightening ability. It is stated that tests are being carried out in the coal grate with the smokeless fuels "on the market;" and if the results are satisfactory, it is hoped that it will be possible to dispense entirely with the use of raw coal in domestic premises, and thus approach nearer the "smokeless city of our dreams." This sounds nice; it also suggests something very tentative. But what solid smokeless "fuels" are they that are "on the market," other than that the gas industry supplies? The semi-coke of low-temperature production is not represented "on the market" by anything nearly sufficient to meet the needs of a city like Glasgow, let alone any other place; and after years and years of labour, the commercial soundness of low-temperature carbonization has yet to be proved.

Other Appliances and a Question of Output.

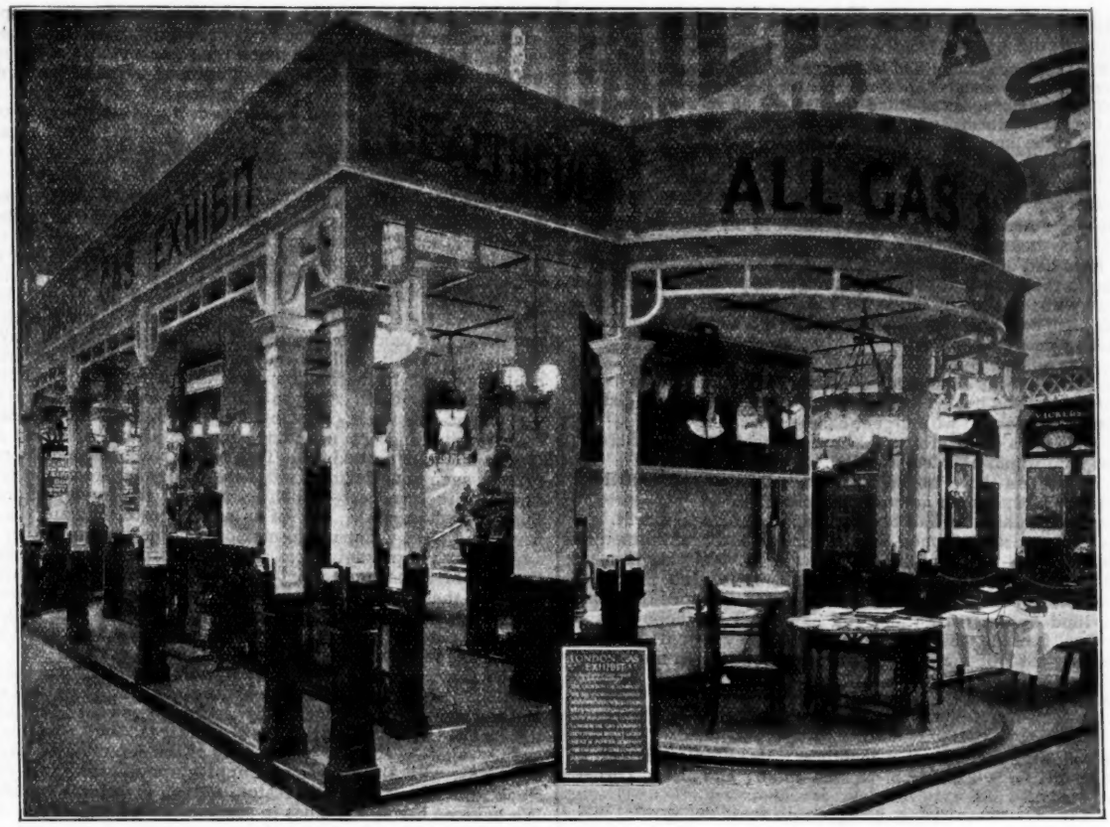
There is electrical luxury here in all its nakedness. "Popularization" from our way of thinking means something that is attractive economically. There is a complete electric lighting installation; and we read: "Examples of the latest types of electric fittings are to be seen in the various apartments; and it is worthy of note that the use of electric light enables unique decorative and furnishing effects to be obtained, while the provision of floor and table standard lamps, with their delicately coloured silk shades, adds the necessary charm." All the rooms are "heated" electrically. Ventilation is by means of small gratings located in the upper part of the walls. The type of electric heater provided for use in the bed and bath rooms is "said" to cost only ¾d. per hour to run. At 1d. per unit, that would only mean three-quarters of a unit, or an expenditure of 2565 B.Th.U. Are these bed-rooms the size of box-rooms, or what are their dimensions? There are all sorts of electrical sundries in the various rooms. In the scullery there is an electrically heated calorifier with a 20-gallon storage tank, and a 3-kw. circulator supply. An electric instantaneous water-geyser is also provided, as well as a 3-pint electric kettle. An electric-cooker is fitted; and there are an electrically operated dish-washing machine, a clothes-washing machine, and a clothes boiler. Among other things in the scullery are a radiator, a fan, and an iron. The "Electrical Review" says it is hoped many who are afforded an opportunity of seeing a modern house not only lighted electrically, but equipped with modern electric labour-saving devices and conveniences, will not rest content until they have seen similar appliances installed in their own houses. But the "Review" omits to state what it is all going to cost—first in installation, secondly to run, and thirdly to maintain. The article is spoilt by the omission. It does not supply the cubical capacity of the rooms to ascertain whether, if they have good heat-retaining walls in the extremes of cold weather, the heating capacity of the radiators will be even theoretically sufficient, let alone so in practice. It tells us nothing about the time and cost factors in the matter of water heating. The article concludes with a reference to an "important experiment" carried out by the Glasgow Corporation in 1918 in two tenement houses. The results were set forth in an article which declared that "if all the houses in Glasgow were similarly equipped, the output of energy for domestic purposes would be no less than 2½ million kw.-hours per annum." Two-and-a-half million! Is there not some mistake here? Two-and-a-half million kw.-hours equal 8,550,000,000 B.Th.U., which is the quantity of potential heat energy contained in (say) 285 tons of coal! That heat energy, it is seriously said, would be sufficient to meet the requirements for domestic purposes if all the houses in Glasgow were similarly equipped. This is really humorous. The generation of 2,500,000 units of electricity, assuming a consumption of 3 lbs. of coal per unit, would require 3348 tons of coal. Is even this sufficient for all the domestic heating of Glasgow? We need not trouble to ask the coal merchants. Perhaps the "Review" will look into their assertion.

THE LONDON GAS EXHIBIT AT OLYMPIA.

We give to-day two views of the display at the Ideal Home Exhibition now running at Olympia, which has been arranged by co-operation of the eight big London Gas Companies—the Gas Light and Coke, South Metropolitan, Commercial, South Suburban, Brentford, Wandsworth, Wimbledom, and Epsom, Tottenham, and Croydon. The pictures show the nature of the



THE LONDON GAS COMPANIES' DISPLAY AT THE IDEAL HOME EXHIBITION—DEMONSTRATING THE RELATIONSHIP OF THE THERM TO CUBIC FEET.



ANOTHER VIEW OF THE LONDON GAS COMPANIES' DISPLAY AT THE IDEAL HOME EXHIBITION.

admirable display made—a full account of which will be found on p. 564 of last week's issue of the "JOURNAL."

Last Thursday evening, in the Conference Hall at the exhibition, Mr. Dean Chandler, of the South Metropolitan Gas Company, delivered a popular lecture on "Reasons Why Gas-Fires should be Used in the Home," with a historical sketch of the evolution of the gas-fire. He pointed out that the reasons why gas-fires should be so used are the desirability of reducing the smoke evil with its destructive effects upon health, and with a view to lessening household labour, &c. From quite early times it was recognized by those in the gas industry that the application of gas for domestic heating was a thing to be desired; and from 1849 inventors have exercised their ingenuity to devise apparatus for this purpose. It was not, however, until Bunsen in 1855 gave us the atmospheric burner that the production of an efficient substitute for the raw-coal fired grate became possible. From that time to the present day of highly satisfactory, labour-saving appliances, the lecturer sketched the progress of the gas-fire through its various stages, illustrating his remarks with about sixty slides and a number of exhibits.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

THE Annual General Meeting of the Midland Association of Gas Engineers and Managers was held at the Grand Hotel, Birmingham, on Thursday last—Mr. JAMES PATERSON (the retiring President) occupying the chair at the outset.

DEPARTED MEMBERS.

Fitting reference was made by the Chairman to the deaths of Mr. A. Dougall, of Kidderminster, and Mr. John West—an honorary member. The meeting approved the action of the Secretary, Mr. T. Thornton, in sending letters of condolence in the name of the Association; and the members honoured the memory of their colleagues by rising in their places.

EMERGENCY FUND.

The CHAIRMAN pointed out that at the last meeting the Committee were instructed to prepare a scheme for a District Benevolent Fund. The matter had received consideration; and it was recommended that such a fund be formed, but that it should be called an emergency fund. The Committee had received a letter of thanks from Mrs. Ainsworth, on whose behalf a collection was made that yielded £21 8s. 6d., and £10 10s. was paid by the Association. In addition, the Commercial Association forwarded £10 10s. from their own funds. It was to meet emergency cases such as this that the Committee were directed to prepare the scheme. The suggestion to form what was on the face of it a benevolent fund was looked upon with alarm by the Benevolent Fund Committee of the Institution of Gas Engineers in London. One could, of course, sympathize with their point of view, because to them it appeared there would be two funds in the country for the same, or similar, objects. There also existed a similar fund which operated with the North British Association in Scotland. He was present at a meeting of the Benevolent Fund Committee of the Institution (of which he was a member) when the question was considered; and he endeavoured to reply to the criticisms that were made, and to afford necessary information. He pointed out that there need be no clashing between this purely local fund and the central fund; and believing this, he cordially supported the establishment of a Midland emergency fund. The fear entertained was that there would be overlapping in charitable effort. This was always to be deprecated, of course; but he did not think it would occur. Their point in the Midlands was that an emergency fund would enable, in cases of distress, help to be given more expeditiously than was possible by the central fund, because a certain amount of necessary investigation had first to be made. His idea was that the Midland fund would meet cases which did not come within the purview of the Benevolent Fund of the Institution, because that was only applicable to the relatives of members of the Institution itself. There were a number of members in the Midland Association who were not members of the central body, and there might be gas engineers in the Midlands who were not members of the Midland Association; but he was inclined to think that the Committee which would administer the emergency fund would be prepared to waive even the question of membership in cases of exceptional distress in the house of the widow and family of a gas engineer. The difference between the two funds was this—the Midland fund was merely to afford immediate and temporary help; the continuance of relief was the function of the central body. The proposal was that the subscription of the Association should be reduced from 10s. 6d. to 10s., and that an additional 2s. 6d. be paid—making 12s. 6d. for the year—to be allocated to the emergency fund.

Mr. HUBERT POOLEY (Leicester) moved the following resolution:

(1) That an Emergency Fund be formed for the purpose of affording relief to any member, past member, or dependents thereof.
(2) That the management of the fund be vested in the Committee for the time being, with power to act in their absolute discretion up to the limit of the funds available.
(3) That rule 13 be amended so as to read "12s. 6d." instead of "10s. 6d.," and that the following words be added, "and that 2s. 6d. of the subscription be credited to the emergency fund."

Mr. Pooley stated that he had a good deal to do with the formation of the benevolent fund in the North British Association. That fund had done splendid work, and he had since been quietly moving in the hope that some day it might be possible to establish a fund with a similar object in the Midlands. He was glad that day had now arrived. He thought its worth would be generally acknowledged.

Mr. FERGUSON BELL (Derby) seconded the resolution, and pointed out that the emergency fund was not intended to be in substitution of the benevolent fund, but merely as a local district auxiliary fund to deal with urgent cases of necessity.

Mr. G. HELPS (Nuneaton) said he was doubtful if a half-crown subscription would be adequate.

Mr. FERGUSON BELL hoped many members would contribute more than the minimum amount prescribed.

Mr. POOLEY said this had been anticipated to some extent.

The CHAIRMAN mentioned that a nucleus had been formed by a few members who had subscribed £11 5s. 6d. He thought this did credit to the kindly feeling of some of the members. He took the opportunity of commending to their notice the benevolent fund of the Institution, and expressed the hope that, as they were forming the emergency fund, they would take the opportunity also of increasing their contributions to the central fund.

The resolution was carried unanimously.

NEW MEMBERS.

The following were elected members: Mr. Stanley Sadler, of Solihull; Mr. G. S. Eunson, of Northampton; and Mr. S. Turner, of Chasetown.

ANNUAL REPORT.

The annual report and accounts were approved on the motion of Mr. W. C. GOODCHILD (Derby) seconded by Mr. W. G. S. CRANMER (Willenhall). The former inquired as to outstanding subscriptions; and the Chairman replied that there were not many arrears.

The report of the Commercial Association was adopted without comment, on the motion of Mr. SMITH.

The CHAIRMAN gave a cordial welcome to Mr. Davies, of Chesterfield, the President of the Manchester Institution.

REPRESENTATION ON THE COUNCIL OF THE INSTITUTION OF GAS ENGINEERS.

The CHAIRMAN moved the appointment of Mr. W. H. Adams, of Bilston, the President-Elect, as representative on the Council of the Institution of Gas Engineers, and expressed the belief that in him they would have a most efficient representative. The Chairman coupled with the resolution a vote of thanks to Mr. J. R. Duff, of Banbury, for the excellent way in which he had discharged his duties during the past two years.

Mr. B. W. SMITH (Walsall) seconded.

Similar acknowledgment was also made to the Chairman's work.

INDUCTION OF THE NEW PRESIDENT.

Mr. ADAMS, the newly elected President, was then invited by Mr. Paterson to take the chair. He paid tribute to his business acumen and sound judgment. He had been at his right hand during the past twelve months. Amid applause Mr. Adams, on taking the chair, was installed with the badge of office.

The PRESIDENT moved a hearty vote of thanks to Mr. Paterson for his services as President during the past year. He had filled the office with conspicuous ability, and all felt under a deep obligation to him.

Mr. W. S. MORLAND (Gloucester), who seconded, said he had watched Mr. Paterson's career for many years, and the progress of his old assistant had given him much pleasure. They would be interested to know that his father had also occupied the office of President of the Association. Their retiring President was at one time President of the Southern Association. He had filled the chair during a year which had been a very trying one for the industry; and he had helped forward many matters with marked ability.

The resolution was cordially approved.

Mr. PATERSON suitably replied, claiming that it was to him a source of great satisfaction that he had made many friends in the Midlands.

The PRESIDENT then delivered his

PRESIDENTIAL ADDRESS.

The unfettered discretion given to your President in his choice of topics for his official address permits me to refrain from the risk of wearying you with a minutely detailed description of the works under my charge. Had we any great novelty of plant, working, or conditions, I might have invited your attention to its consideration; but as it is an average works in most respects, where we are carrying out our statutory obligations to the best of our ability under conditions much the same as those of other gas undertakings, it would be as presumptuous as needless to dwell upon what could have no special interest to you. Neither shall I burden you with a lengthy address or a very wide survey of the gas horizon. I propose, therefore, to confine myself to a few clearly-defined points.

TAXATION.

The chief anxieties of the gas industry to-day, as of other industries and individuals, are financial. The crushing burden of taxation is most serious, and is forcibly brought home to those who, like myself, are secretaries as well as engineers of gas companies. The result in our case may be put in a nutshell. In 1913, we paid in rates and taxes £1200, and paid in dividends (free of tax) £5375. To-day, rates and taxes claim £5890, and the dividends paid are only £2600. We are unable to pay our standard dividend; and not only are the shareholders suffering a continuous loss of income, but their capital holding is practically depreciated to half. A share that would have sold in 1913 for £12 might now fetch £6. Obviously, investors look askance at such results, and are unwilling, because afraid, to invest more money in gas undertakings. This reacts powerfully on the enterprise of such undertakings, and those concerned are seriously perturbed at the prospect—which is ours—of the imminent need of raising fresh capital. Few of us can hope to emulate the Gas Light and Coke Company in making a large investment in fires and cookers at present prices, and in restoring a general offer of the hire of these, and, in doing so, both stimulating the development of their own undertaking and assisting the trade revival of the country. We admire and applaud those who can, and dare, advance in this way; but we cannot follow suit, much as we should like to do so.

The Gas Regulation Act of 1920, which confers some valuable privileges, especially in the way of freedom of working, will make matters a little easier financially, especially to those who obtain their new Orders and their new standards; but effective and lasting relief will be the result only of the reversion to pre-war dividends, with the consequent appreciation in the value of gas stock and shares and the restoration of investors' confidence. We have no heroic remedies to suggest, nor do we ask for doles. We consider the Government have scarcely dealt justly, and certainly not generously, with us, over our war-time efforts for the Ministry of Munitions. To the supreme importance of our bye-products, and our efforts to conserve and increase them, we have had plenty of flowing testimonies; but the hard cash paid for our ammonia, spent oxide, and tar products was neither commensurate with their vital importance to the nation nor with the prices freely paid in other directions for raw and manufactured articles. We do not labour the point, nor do we regret our war-time efforts; but we have, in effect, been penalized for them. Still, we ask not for doles—we can work-out our own financial salvation if the odds be not weighted against us by the incidence of taxation.

Our only hope lies, first, in a general lowering of taxation, and especially of the income-tax and of local taxation. Much of the advance in local taxation is due to the wages bill; and in this matter public bodies are in the same boat as we are. Nevertheless, a note of alarm needs to sound out from many quarters on the question of doles, of relief, especially out-of-work relief. Relief there must be. The time is long since past when a French princess who heard the people were starving for want of bread could, in all seriousness, say "Why don't they eat cake?" The French Revolution of 1790 followed that state of affairs. Our hearts are sore at the sight of worthy men—men who risked their lives for us in the war, and are willing to risk them for us in the arts of peace—seeking for work, unable to find it, and compelled to accept charity. Unemployment cannot be abolished by passing resolutions; it can only be ended by restored and extended trade. Although there have always been, and always will be, slackers who prefer a living to drop into their hands, rather than having to win it by those hands, and although there are always more looking for jobs than for work, yet we all realize that the vast majority of the unemployed are worthy Britishers who much prefer work to charity, and self-respect and independence to being "doled."

Local relief works ought, whenever possible, to give the community some tangible return for the relief payments. I know the enormous difficulties. You cannot wisely set men used to sedentary employment, or to that needing delicacy of sight and touch, to road-making in mid-winter. Your relief works may ultimately prove most expensive, and are necessarily difficult to devise as quickly as the need arises, and carry out and supervise wisely and well. Were they easy to suggest and sure to prove profitable, they would almost certainly have already been undertaken by private capital. Relief ought not to be merely a giving of money for nothing; it ought to be wages for some work, even if that work be not wholly self-supporting.

Although one may have no effective remedy to suggest, or hardly even a helpful suggestion to offer, it is permitted to all of us to point a warning finger, and call a halt when faced with the demands made in some quarters as to the amount of such relief per family or per head. That the protest is not uncalled-for is proved by statistics from many districts. Let me quote one local case. At Bilston, the ironworkers' wages are now low—so low that the men are threatening to leave their work and take the relief grants. This is not an isolated case, as Sir Alfred Mond

told the recent Central Conference of Poor Law Guardians that a master-cutler of Sheffield had told him that in his own works men who were on short time had given notice with this plan in contemplation. We have probably all heard of men now getting practically as much for doing nothing as when in full work.

This state of affairs is calamitous—not only financially, but morally. It will weaken moral fibre and undermine self-respect. It is removing the great incentive to work, and certainly to such zealous work as the country now needs so much. Principle is greater than policy; and though handing-out money has been only too easy for the Government for years past, doles, doles, doles can never save the situation. A halt has to be called in the progressive outflow of money. Those young men who, perhaps in munition working and ever since they began working, have been allowed to put forth a minimum of effort and not allowed to exceed a carefully regulated output, though rewarded with ample wages, have now to get back to a saner and more British view of work. There are many welcome signs that this is taking place. The spontaneous and intelligent acquiescence in this call to strenuous work will do very much to bring this country again to prosperity, peace, and happiness.

COAL.

The main items in a gas undertaking's outgoing are for coal and wages. The latter are coming down reasonably; but the former has not, and collieries show a disinclination to make an adequate move in this direction. There has been talk of coal that shall be sold at 20s. per ton below the pre-strike prices; but nothing like this reduction has materialized—the greatest concession being only about 12s. The quality of the coal is improving; but there is still not only room, but an urgent need, for further improvement in the amount of inert matter delivered and charged for as coal.

Reductions in carriage have as yet been but slight, and for the coal on which so many of us depend—viz., Yorkshire—no concession at all has been made in the rates charged. Concessions are overdue from another quarter, too—viz., from coalowners and merchants who use their own private wagons. The rates for these should certainly be reduced as low as those of the railway companies. Formerly they were lower, now they are higher, than those charged for the railway companies' stock.

WHAT QUALITY OF GAS?

In deciding on what quality of gas to adopt for the declared value in the new Order which we at Bilston have obtained, and which comes into force on April 1 next, we were guided largely by local conditions. Our declared calorific value is to be 450 B.Th.U.; and we shall dilute straight coal gas, made in our horizontal settings, with water gas, to reach this figure. Our Humphreys and Glasgow plant stood us in good stead during recent years, and alone helped us to round some very awkward corners, especially during the coal strike of 1921. As I mention elsewhere, we were fortunate in always having oil on hand to enable us slightly to carburet the blue gas made.

A more extended gasification of the fuel than was secured in the old straight coal-gas days is now usual. How far this should be carried is a point which may be discussed from several points of view, and permits of different opinions, all perhaps equally well-informed and well-considered. Much also depends on the nature of the plant available. Vitally governing the whole question, too, is our individual attitude to the amount of carbon monoxide and of inerts that we see fit to include in our town gas. Anything like complete gasification may be found to present difficulties and drawbacks which it is almost too soon to discuss, and about which it is wholly too soon to dogmatize. To my mind, this question is not one with only a single answer, and local circumstances may rightly prove the deciding factor.

At Bilston, we could always sell more gas coke locally than we have for sale. It is mainly used industrially for galvanizing, welding, &c.; and several works have their own water-gas plants. For some of the operations concerned, coke-oven coke is not equally suitable—the users say this, it is not sale-pushing talk. We, at least, should be unwise to deny our customers the privilege of using locally made gas-coke, because we took further steps towards complete gasification. We feel we cannot penalize these solid gas-fuel users for the more or less problematic advantage of gas users; and we intend to live up to our title of the Bilston Gas Light and Coke Company.

We know, of course, that the reasons which appear to us to give full justification for our decision would not apply to such a case as (say) Cheltenham—a watering place with a minimum of industrial coke users. Its gas undertaking might reach the same ultimate decision as we have done; but it would be along different lines and for different reasons. To repeat, I consider that the question of the degree to which any undertaking should approximate to total gasification does not admit of one solution applicable to all cases, but must largely be determined by local conditions, especially those of the plant and those connected with the consumers.

CARBON MONOXIDE.

One can hardly escape having at the present juncture to refer to the question of carbon monoxide. I have barely patience to do so, for the recent agitation for restricting its amount in gas strikes most of us as being a very artificial one. Having once been raised, various accidents and suicides afforded some sections of the Press the chance of sensational headlines, and of posing as guardians of the public health and well-being. One would not deny them this rôle, if they only took care to be fully and rightly informed. The whole matter was thoroughly investigated by a Departmental Committee, who had ample powers and opportunities for investigation. When they report that no official restriction of carbon monoxide need be prescribed, the whole question should be regarded as settled—at least until very important and powerful new evidence is forthcoming. This has not been adduced.

We need say nothing about the new Order providing that gas undertakings shall not supply gas for domestic purposes containing carbon monoxide unless such gas possesses the distinctive pungent smell of coal gas. By all means let this provision be included in the statutory obligations if the Board of Trade see any advantage in so doing; but the general public may be excused if the promulgation of this Order just now leads some to imagine that odourless town gas has hitherto been distributed in some cases—which as Euclid says, is absurd, for no one has ever distributed odourless town gas in this country, or would wish to do so. An unfortunate outcome of this ridiculous agitation in certain London papers has been to call the attention of neurotic people to this easy means of "shuffling off this mortal coil," and to increase the number of such suicides. "How oft the sight of means to do ill deeds, makes ill deeds done!" One of the level-headed North Country newspapers with a very wide circulation has very soundly and sanely rebuked its hysterical contemporaries of the Capital.

There is now probably no more carbon monoxide in town gas than before the war, and certainly there is a much lower proportion than was necessary and officially prescribed during the exigencies of recent years. Further, in spite of enormously increased consumptions, the number of gas poisoning cases shows no increase. Suicides may be ruled out of case. Such unhappy mortals would effect their grim purpose by some other means if coal gas were made absolutely innocuous—which, again, is simply impossible. Careless users will always be with us, whatever we do. "Defective fittings" sounds impressive to the man in the street; but we have had our surfeit of "control." These the users must be expected to look after for themselves, as they do in other directions in domestic and business life. An Englishman still regards his home as his castle, and does not welcome inspection of the care he takes of the accessories of his house—especially when all this supervision will have to be paid for in some way or other. Landlords will similarly look askance at the consequent peremptory demands made upon them. Fittings ought to be good and safe; but the whole point is, "On whose shoulders should the responsibility be put?" Gas undertakings certainly do not want it. They could do the work well enough (it would have to be paid for); but they would certainly object to the consequent entire responsibility for mishaps which would be so generally and readily saddled upon them. One must remember that, however complete and correct any appliance or fitting might be made, a clumsy, careless, or spiteful user might have it dangerously wrong a few hours after. No! we do not want this responsibility. Let us have less control, less inspection, and more reliance on self-help. It is a needed tonic in these days.

Now may I crave your indulgence while I refer to some lesser topics, illustrating them from our local conditions and practice at Bilston.

SUBSIDENCE.

Subsidence of the ground, with the consequent fracture and drawing of joints of mains and services, is unhappily familiar to gas engineers in most, if not all, of the coal mining areas; but in a large area in South Staffordshire the trouble is accentuated by special local circumstances. Round Bilston the uppermost seams of coal were very near the surface, and these were exceptionally important, as the chief was the famous 36 ft. seam—the thickest in the country. Active mining operations, in the ordinary sense of the word, ceased in the immediate neighbourhood about twenty years ago. In many places, so near the surface did the coal lie—say, at a depth of about 60 ft.—that sometimes it was not mined, but worked from the surface. Where actual mines were sunk, huge pillars of coal were left in the workings to support the roof—a measure necessitated both by the shallowness of the workings and the exceptional thickness of the seam. These pillars were about 40 to 50 ft. square, and in more recent years have themselves been hewn away and the coal brought to the surface—the only mining carried out locally. This has, of course, led to serious subsidences, in which gas-mains have often suffered grievously.

More serious to the whole country side, however, has been the fact that the subterranean water cannot be kept in check, but has steadily gained on the workings till the lower seams one by one have been flooded, in spite of strenuous and continuous pumping on a large scale. Eventually much coal unwon will have to be abandoned, and all mining discontinued except the aforesaid gleaning in the old upper workings. This large-scale pumping of water, which seems to be able to circulate freely throughout the area, has led to serious and general subsidence, inasmuch as it washes out the soft lower layers over continuous districts. That this pumping is the cause of the trouble is proved by the amount of silt present in the pump water. The close similarity of this to the subsidences caused by brine-pumping in Cheshire is at once obvious. But whereas the expense of the necessary renewal of property in Cheshire is made good from a *pro rata* levy on all brine pumped up, those who suffer from

these South Staffordshire subsidences have had to shoulder their own losses.

As you may expect, constant supervision of mains and close scrutiny of leakage accounts has to be maintained by the local gas undertakings, and repairs have been both frequent and costly. We have now got welded steel mains in the district most affected; and the results have been highly satisfactory.

NAPHTHALENE.

During the past summer, naphthalene troubles were much in evidence at Bilston. "Everything comes to those who wait;" and so at last we had our first experience of the baffling white crystals. We can now reflect with a kind of amused satisfaction that we are professionally "adult," and know the wiles of the world, the flesh, and—naphthalene. The trouble was confined to the summer. Probably the reason may be found in the prolonged hot dry weather depreciating the efficiency of our condensers, and letting much more naphthalene pass with the gas into the district. Once there, the fact that our area is considerably elevated, and the mains on the whole shallow-laid, enabled the persistent north winds to cool these mains and services at certain times to such an extent as to condense out enough of the extra naphthalene to account for all the trouble we experienced. For some time past we have been practically free from naphthalene blockages.

In dealing with these deposits, we have chiefly relied on "Gazine," which we have vaporized into the gas on the works at the outlet of the station governor. This gradually cleared the nearer portions of the district, and transferred some of the cause of the trouble to the outskirts. When troubles or signs of extensive deposition showed themselves there, we added "Gazine" in bulk as a liquid solvent, and pumped it out at the syphons with its contents of dissolved naphthalene.

We were fortunate in escaping the increased occurrence of naphthalene troubles so common in the later war years, when oil-stripping robbed gas of so many of its natural naphthalene solvents. Our respite in the midst of the general trouble we attributed, not by any stretch of imagination, to our superiority in methods of working, but to our very good fortune in always having enough oil to allow us slightly to carburet all the water gas we sent out during those years. Doubtless we were only just within the margin of safety, and deposits in our mains grew unnoticed during the time, and thus made possible our untoward experiences last summer.

VENTURI METER.

Of the Bilston works, and the plant and equipment there, I propose only to refer to one item, which may have some measure of novelty in itself or in the use we make of it. Some time ago, it became necessary to procure a new station meter. At the time, one of the ordinary type would have cost us £900, and a further expenditure of £1500 for a house. Casting round and making inquiries, I was strongly drawn towards the Venturi meter. Investigations into its working at various places finally led us to decide on obtaining one. It cost only £280 erected complete. The principle of this meter is perhaps well known to you; and I will not attempt a full description of its working or construction. The specific gravity of the gas relative to air at the same temperature and pressure may vary considerably. Such variations are automatically corrected, and the actual volume recorded. Periodical examination of the throat to see that it is clean, and inspection of the pressure pipes to see that they are clear of obstruction is all that is necessary to facilitate the checking of the meter for accuracy, which can be carried out *in situ*. The cost of maintenance is very small—in fact, only amounts to the cost of railway fares and time of an inspector twice a year, and which cost may be regarded in the same manner as the cost of the premium you pay for boiler insurance and inspection. The recording apparatus occupies a space of less than 2 ft. square, and can be fixed anywhere within reasonable distance of the tube. At Bilston, the recorder is fixed in the engine-room, some 250 ft. from the tube. For a number of years it has worked in tandem with an ordinary station meter; and the variation between the two lies within *plus* 0·75 p.ct. and *plus* 1·5 p.ct. Our experience has justified our departure from the older practice.

PROSPECTS.

In conclusion, signs are not wanting that the great depression in trade, which is being reflected on the gas industry as a whole, is slowly but surely lifting. Industrial peace, co-operation between Capital and Labour, the recognition of the human element in business, and the taking of a more active interest in the lives of the workers by the introduction, where practicable, of some form of co-partnership or profit-sharing, are factors which, if pursued with courage and determination, will bring us back to our pre-war prosperity.

A Vote of Thanks to the President.

Mr. J. Ferguson Bell, in proposing a vote of thanks to the President for his address, said the subject of taxation had been mentioned, and urged that a deep cut would have to be made in both imperial and local taxation. The existing imposts were such that industries were being crushed out of existence. He believed that as a nation we were greatly indebted to the Geddes Committee for their valuable report; and his only regret was that the Government had not had enough courage to see that the cut was made. He was convinced that before industry could be restored and unemployment abolished something would have to be done to reduce the burden of taxation. It was a matter of satisfaction that gas companies, by means of the application of the Gas Regulation Act, were able to obtain some relief, for gas companies had probably suffered as much or more than most industries as a result of the war. He recommended all companies and undertakings to take advantage of that measure. The Board of Trade were very fair in the inquiries they made and in the relief they gave. Another tax to which they were likely to be subject was the Corporation Profits Tax. At the present time, the tax did not apply to public utility undertakings; but within twelve months he thought they might be included, and he hoped the National Gas Council would take action to safeguard their interests.

Mr. Vincent Hughes (Smethwick) seconded the motion. Referring to the new style of meter in use at Bilston, he advised those who had not seen it to pay a visit to the works and make themselves thoroughly acquainted with this beautiful and very simple instrument.

The resolution was cordially endorsed by the meeting.

The President, in acknowledgment, spoke of the serious way in which the Bilston Gas Company had been hit in the matter of local rates. The area in which they supplied gas was under two Unions, and in that portion controlled by one of them the increase in the Company's rates for the past year had been no less than £1000, solely on account of the granting of relief to the unemployed. The portion under the other Union, which was just as large, and where there was as much distress and unemployment as in the other case, had not involved them in an extra payment of £50. The discrepancy between the two was such that he thought it ought to be further looked into. The general question of local taxation should be taken in hand.

WIRELESS PIPE LOCATER.

By Chas. H. Webb.

Mr. Chas. H. Webb (Stourbridge) gave an interesting explanation of a wireless pipe locater and also a demonstration of its working. The apparatus, he explained, had been in use at the works of his undertaking for four or five years for the purpose of locating the position of underground pipes without the necessity of making trial excavations. In their case, the necessity for the outfit came to a head in 1916, when they were stripping the gas for the Government and getting considerable trouble with naphthalene. At the same time a large number of the outdoor men were away, and they had difficulty in locating services that would not blow. They consequently purchased the apparatus, and had since made extensive use of it.

Mr. Webb gave the following description of the device:

The apparatus consists essentially of a battery of dry cells, or a small accumulator connected to the primary circuit of a special induction coil, and a pair of telephone receivers attached to the "listening" coil. Wires from the secondary circuit of the induction coil are connected-up in any convenient way to cause a current to flow through the pipes of which it is desired to settle the position underground. For instance, if it is the service-pipe from the main to a house which is to be located, the secondary circuit of the induction coil would be connected to the meter-inlet on one terminal, and from the other terminal a loose ground wire would be run (say) to an adjacent lamp-post, or possibly to the meter of the next house.

On starting the primary current, the secondary current is induced, and flows through the circuit formed from the gas-meter, along the service-pipe, along the main to the lamp post back through the loose ground wire. The area so described forms what is called a "field" with a current flowing all round it. The operator now takes in his hands the "listening" coil, which is a light coil laid on a wooden frame, and places the two telephone receivers to his ears, which receivers are in circuit with this coil. If he then stands in the "field," current is induced in the coil which he carries, and a similar buzzing to that given by the interrupter of the induction coil is heard through the telephone receivers. As soon as the portable coil comes over the edge of the "field," the buzzing is no longer heard. If it is carried further, and taken outside the "field," buzzing recommences, but has a different and weaker sound. By this means they can trace exactly the track of the service-pipe. The operator takes up a position where he is more or less certain that he is in the "field," and then moves until he notices a difference in the tone of the buzzing. He is then over one of the boundaries of the "field," either the ground wire or the underground pipe. It is generally convenient to go to the ground wire to make sure that the circuit is well established. He can then move across the "field" until the difference in sound is detected, when he will know that he is over the desired pipe. He should then swing the coil from side to side across the pipe, and at the same time walk backwards tracing the track of the pipe on the ground with his foot.

The whole apparatus is extremely simple, and one can learn to use it in the course of half an hour; but, of course, with greater practice one could gain speed and experience in interpreting the sounds through the telephone receivers.

The outfit as received from the makers is packed in a small box weighing about 20 lbs. To the equipment we have added another box with about 110 yards of 3-22 cab-tyre sheath cable wound on a drum; the inner end of the wire being connected through the axle to a terminal on the outside of the box, so that, when laying the ground wire previously referred to, all that is necessary is to place this box near the wireless box, connect a secondary terminal of the induction coil to that of the axle of the cable box, and run out sufficient cable from the box to make the necessary connection.

The particular apparatus we have in use is of American origin; but I believe there is also an English-made one on the market. The apparatus gives astonishing results, is in frequent use, and

has saved its cost many times. It may be said that there should be no use for such an apparatus on a well-conducted gas-works, as the position of every pipe in the district should be accurately plotted; but most works are not so fortunate, particularly in the matter of records of old pipes which have been underground many years. Of course, the apparatus not only locates gas-pipes, but will locate any metal pipe, or indeed any underground line which will conduct the electricity furnished by the secondary part of the induction coil.

I have also another useful tool called a dipping needle, which can be used in conjunction with the wireless apparatus in special cases. It is sometimes found that a valve or syphon cover in the roadway has become hidden by macadam after a road has been repaired. The exact line of the main can be settled by the wireless apparatus; and if the dipping needle (which is usually a compass) is carried along this line, the dip will alter when the valve-cover is approached, and its exact position can be quickly determined.

Mr. Webb then described: (1) The arrangement of the normal circuit. (2) The cross-over or figure 8 circuit. (3) House circuit with water-heater. (4) Finding a dead-end of branch main. (5) Possible bye-pass to meter. The description was followed by a demonstration of the apparatus.

DISCUSSION.

The PRESIDENT proposed a hearty vote of thanks to Mr. Webb for introducing to their notice an apparatus of which the bulk of them probably did not know much about. To gas companies, or even water undertakings, who had not a perfect map of their mains, the apparatus must be of very great use.

Mr. W. A. TWINE (Birmingham), in seconding, inquired whether Mr. Webb could give them any information as to the use of the apparatus at works other than gas-works. He wondered whether it would be possible to trace underground steam, water, or other pipes where there were cross services. He would also like to know what would be the effect where they had, perhaps, a series of four pipes.

Mr. WEBB replied that the first test he made was on the water-main in the gas-works yard. He traced the service-pipe to the works water-main and back. He had also located steam-mains. With a little experience, he added, they could locate any metallic conductor.

Mr. H. DAVIES (Chesterfield) mentioned that he had used an English apparatus which was simpler than that described by Mr. Webb, and equally effective. By its use he had succeeded in finding a pipe at a depth of 9 ft.

Mr. F. C. BRIGGS (Dudley) agreed with Mr. Webb that in a very short time the apparatus saved its cost. He advised those who were not electrical engineers to beware of a short-circuit when using the outfit, as it would be likely to lead them astray.

The resolution was cordially approved.

THE SPRING MEETING.

The President invited the Association to hold their spring meeting at Wolverhampton, in which case the Directors of the Bilston Gas Company would be their hosts and entertain them. On behalf of Mr. Winstanley, who was unable to be present, he asked the visitors on that occasion to inspect the Wolverhampton Gas-Works, where they had recently expended a lot of money on new plant. So that there would be a great deal to interest them.

The invitations were gratefully accepted by the meeting.

A Difficult Main-Repairing Job.

The death has just occurred, at the age of 89, of Thomas Ockerby, who was an annuitant of the People's Gas Company, of Canada. He was well known to the past generation of gas men, and at one time gained fame for a remarkable feat which might have cost his life. In 1862 a steam tugboat blew-up in the Chicago River; and shortly afterwards it was found that a 24-in. gas-main under the river was filling with water. The valves were closed both ends, and Ockerby crawled through, bringing back with him a piece of grate-bar from the tug-boat, which had been blown clean through the pipe. In order to make it at all possible for anyone to enter the pipe, it had been necessary to get the fire-engines first to pump out the water and then pump in air. Ockerby once said the last thing he heard when he went down the pipe was the remark, "How are we going to get this fellow out if he dies down there?" William Stray, then blacksmith for the Company, accompanied Ockerby on his next trip into the pipe. One of them went in feet first, so that they were head to head in the pipe. They took some short-handled hammers to turn the burrs made in the passage of the grate-bar through the pipe. Then, by means of a bar of iron and a turnbuckle, they braced a dam of rubber, lead, and iron into the crack. The job held as long as the pipe remained in service.

Chemical Works Regulations under the Factory Act.—Notice is given under the Factory and Workshop Act, that the Secretary of State proposes to make regulations to apply "to the manufactures and processes incidental thereto carried on in chemical works," in accordance with a draft, copies of which may be obtained on application to the Factory Department, Home Office, London, S.W. Any objection to the draft regulations must be sent to the Secretary of State within twenty-one days of the date of this notice, which is March 3. Certain of the proposed regulations apply to works in which gas tar or coal tar is distilled or is used in any process of chemical manufacture.

MIDLAND JUNIOR GAS ASSOCIATION.

A meeting of the Midland Junior Gas Association was held at the Council House, Birmingham, on Thursday last, Mr. WILLIAM BATT (President) in the chair. There was a representative attendance of members.

At the outset, reference was made by the Chairman to the resignation of Mr. B. J. Bell, the Hon. Secretary of the Association, who had received an appointment at Cardiff. Upon this fact they extended their warm congratulations. During the few years he had held the office of Hon. Secretary he had worked exceedingly hard, and rendered most excellent service for the Association. For this they felt very indebted. The Committee had given consideration to the question of a Secretary, and they recommended the appointment of Mr. H. R. Hems. To Mr. Bell he moved that a hearty vote of thanks be accorded.

This resolution was seconded by Mr. C. F. W. RENDLE (Redditch) and carried unanimously.

In his reply Mr. Bell said he greatly appreciated their expression of thanks. What he had done for the Association had given him real pleasure, for he recognized the great importance of the Junior Associations, which was proved, too, by the fact that men distinguished in the gas industry gave them lectures containing the benefit of their experience and research.

Mr. T. F. E. RHEAD, M.Sc., Chief Chemist at the Birmingham Gas-Works, then read the following paper on "Some Notes on the Chemistry and Physics of Gas-Works Refractories," the Chairman remarking that this was the third paper Mr. Rhead had given before the Association. The paper was illustrated by experiments and lantern slides, kindly lent by Dr. J. W. Mellor.

SOME NOTES ON THE CHEMISTRY AND PHYSICS OF GAS-WORKS REFRACTORIES.

In the course of our rather extensive testing of refractories at the Central Laboratory, it struck me that a lecture on the important subject of "Refractories" should prove of interest to this Association.

After considering the complexity of the subject, it seemed to me that a useful purpose would be served in talking about the chemical and physical properties of the raw materials and finished products. This method of treatment provides the soundest means of obtaining a clear conception of what it is reasonable to expect from the various refractories used in the construction of carbonizing plants, &c.

According to their chemical behaviour at high temperatures, refractory materials can be classified as acids, bases, or neutral bodies. The acid refractories include kaolins, ball clays, fireclays, siliceous clays and rocks, silica rock and sand. We are chiefly concerned with the last three groups.

COMPOSITION OF CLAYS AND SILICEOUS MATERIALS.

The following analyses are typical of the materials under discussion (from Searle).

TABLE I.

Clay.	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Alkali.	Water, &c.
	P.Ct.	P.Ct.		P.Ct.		P.Ct.	P.Ct.
China Clay, St. Austell .	46	39	—	0·5	—	0·5	14
Ball Clay, Dorset . . .	49	32	2	0·5	—	3	13·5
Fireclay, Stourbridge . .	65	22	2	0·5	—	0·5	10
" " Glenboig . .	46	36	2	—	—	0·5	14·5
" " Leeds . . .	71	20	1·5	0·5	—	1·0	6·0
Ganister, Sheffield . . .	90·0	7·4	1·0	0·4	0·5	1·0	—
Dinas, Wales	98	1·0	1·0	—	—	—	—

TiO_2 is included in the figures for SiO_2 and Al_2O_3; it is under 2 p.ct.

Ordinary analysis has only a limited value in showing the true composition of these materials, and it is more by the help of mechanical and physical analysis—such as elutriation and microscopic investigation—that a true insight into their nature can be obtained.

From the mineralogical aspect, fireclays may be regarded as consisting essentially of crude alumino-silicic acids (the true clay substance) and varying proportions of the following compounds:

Alkaline alumino-silicates—*e.g.*, mica.
Silicates.
Silica—anhydrous and hydrated (amorphous).
Iron compounds—hydrated oxides, carbonates, sulphides, &c.
Titanium compounds—TiO_2, $TiFe_2O_3$, $TiCaO_5$.
Calcium compounds—carbonates, sulphates.
Magnesium " " "
Potassium " } usually double silicates.
Sodium "
Organic matter.

Siliceous materials can be considered as various forms of silica, more or less mixed with clays; and silica materials are practically pure silica with only a few per cent. of impurities.

PROPERTIES OF FIRECLAYS.

Plasticity.—One of the most valuable properties of clays is that of absorbing water and forming a plastic mass. This property of plasticity appears to be due to the films of water surrounding the

clay particles, a certain proportion of which are in the colloidal* condition. The presence of organic colloids is a further aid to plasticity. The films of water surrounding the particles act as lubricants, and enable the particles to slide over one another without cracking of the mass.

As one would expect, the degree of plasticity will depend to some extent on the quantity of colloidal matter in the clay, both inorganic and organic, and the extent to which this colloidal matter is hydrated. The plasticity of a clay increases with increasing water content up to a maximum, and then decreases. The point of maximum plasticity is reached with less water when the clay is worked under pressure.

The methods of increasing or decreasing plasticity indicated above are used extensively in the manufacture of refractories—*e.g.*, the Refractories Research Committee (1920) found that in casting retorts, if approximately 0·3 p.ct. of alkali mixture is added to the mixture of clay and grog, a liquid "slip" is obtained which pours quite readily, containing about 21 p.ct. of water; whereas the average clay in condition for moulding contains about 25 p.ct. of water. The "setting" of the slip after casting is caused by absorption of water and some alkali by the walls of the mould.

Binding Power.—Another important property of clays is their binding power, which is closely related to plasticity. The amount of non-plastic material that can be mixed with a clay without seriously destroying its plasticity depends on the binding power.

Shrinkage of Clays on Drying.—When a mass of plastic clay is slowly dried in air, the particles slide over one another and pack more closely together—the mass undergoing considerable shrinkage. As the drying process is continued, there comes a stage when the particles cannot pack any tighter, and further loss of water is accompanied by the formation of pores in the mass. The correct rate of drying clay goods is very important, as too rapid drying causes cracking and serious distortion. As we shall see later, this troublesome property of shrinkage is partly counteracted by the addition of non-plastic material called grog.

Cohesion.—Powders of most materials when moistened and dried readily assume the powder form again; but clay has the rather remarkable property of drying to a hard compact mass—owing to the cohesive forces between its particles. This cohesive property varies with different clays, and the more pronounced it is, the more easily are the dried clay goods handled without breaking before firing.

Effect of Heat on the Various Constituents of Clays, &c.

(1) *Silica.*—This material occurs in many different forms in nature; and under the influence of heat, various isomeric modifications can be produced.

Quartz is the densest form of silica, and when heated to the requisite temperature a slow rearrangement of the molecules takes place and cristobalite or tridymite are produced as crystalline forms of silica of lower gravity than quartz and correspondingly greater volume.

The following modifications of silica are known:

Modification.	Sp. Gr.	Melting Point.
α Quartz	2·65	
β Quartz	..	
α Cristobalite	2·33	1710 ± 10° C. Insley and Klein
β Cristobalite	..	
α Tridymite	2·27	1670 ± 10° C. ,, ,,
β Tridymite	..	
β_2 Tridymite	..	
Amorphous silica	2·2	
Fused silica	2·2	

According to Ross (U.S. Bureau of Standards), the inversion temperatures are as follows:

Inversion.	Temperature.	Remarks.
Quartz ⇄ β Quartz	575° C.	Rapid, reversible
β Quartz ⇄ β_2 Tridymite	870° C. ± 10° C.	Very sluggish; do.
β_2 Tridymite ⇄ β Cristobalite	1470° C. ± 10° C.	,, ,, ,,
Tridymite ⇄ β_1 Tridymite	117° C.	Rapid, reversible
β_1 Tridymite ⇄ β_2 Tridymite	163° C.	,, ,,
Cristobalite ⇄ β Cristobalite	220° – 275° C.	,, ,,

* *Note on Colloid State.*—The behaviour of the colloidal clay becomes more explicable if we consider it from the following points of view (see Mellor on "Plasticity," Journal Ceramic Society, 1921).

When the molecules of the solid attract those of the liquid more strongly than they attract one another, and more strongly than the molecules of the liquid attract one another, the water forms a film round the solid particle, which film tends to enlarge until equilibrium is reached, at which point the film is nearly the same thickness as the radius of action of intermolecular attractive forces. The particles will then repel one another if brought nearer together than twice the radius of action of the molecular forces. This corresponds with the phenomenon of deflocculation.

If, on the other hand, the attractive force of the liquid for the liquid is greater than that of the solid for the liquid, the particles will tend to approach closely to one another—*i.e.*, the particles will flocculate. These molecular attractions and repulsions are greatly influenced by dissolved reagents—*e.g.*, deflocculation of clays suspended in water can be brought about by the presence of very small quantities of bodies which increase the hydroxyl ions in solution, such as alkali-hydroxides, alkali-carbonates, and salts of weak acids. These reagents decrease the plasticity of clays.

Flocculation or coagulation can be brought about by those bodies which increase the hydrogen ions in solution—such as acids, acid salts, lime, calcium sulphate, sodium chloride, and most neutral salts. These reagents increase the plasticity of clays.

The change from α to β quartz and the reverse change are fairly rapid, but the changes to tridymite and cristobalite and the reverse changes are very slow, and require a long heating at a high temperature. The slowness of these changes explains why tridymite and cristobalite remain stable at ordinary temperatures when quartz is really the most stable form. It should be noted that tridymite and cristobalite undergo minor inversions at low temperatures as seen above, but unattended by large volume changes.

The complete transformation of quartz to cristobalite gives an increase in volume of 13·6 p.ct. and to tridymite an increase of 16·8 p.ct.

The permanent expansion of silica brick after the usual commercial burn amounts to about 10 or 11 p.ct. by volume according to McDowell.

Hydrated silica, when heated, loses water and changes into amorphous silica, and at high temperatures passes into the cristobalite or tridymite forms.

Silica produced by the decomposition of the alumino-solicic acids in the clay when the latter is heated is said to be in the amorphous form and probably behaves as indicated above, in so far as it does not combine with alumina to form sillimanite (Al_2O_3 SiO_2). Sillimanite forms slowly at 1200° C.

(2) *Alumina.*—This compound occurs in fireclays chiefly in the combined state, but is produced when the clay substance is decomposed by heat. Unlike silica, alumina contracts when heated, and between 800° and 1200° C. its gravity increases from 2·8 to about 3·9, corresponding to a contraction of about 30 p.ct. The alumina molecules are said to have polymerized, and in this form the oxide is almost insoluble in acids. This contraction of alumina, in addition to being of considerable magnitude, is very sluggish, and has proved a great source of trouble in making alumina refractories. According to Kanolt, pure alumina melts at 2000 to 2050° C. Alumina behaves as a feeble acid or base according to its company.

(3) *Alumino Silicic Acids. True Clay Substance.*—When heated, these bodies lose water at about 500° C., and decompose into amorphous silica and alumina, which behave as above.

(4) *Alumino Silicates.*—As will be seen from the following table, these minerals are of low melting point, and when heated they fuse and act as serious fluxes on the surrounding material.

		Melting Point—° C.
Orthoclase	K_2O Al_2O_3 6 SiO_2	1200 (Dittler)
Labradorite	Na Ca Felspar	1245 to 1250
Muscovite (common mica)	$K_2O_2H_2O$ 3 Al_2O_2 6 SiO_2..	1255 to 1290

(5) *Iron Compounds.*—Most natural clays contain iron compounds which are returned as Fe_2O_3 in the ordinary analysis.

Iron occurs usually in the form of the hydrated oxides, sulphides, and carbonates, &c. These compounds are decomposed by heat, generally producing mixtures of the oxides FeO, Fe_3O_4, Fe_2O_3; the relative proportions of each depending on the atmosphere in which the clays were heated—*i.e.*, whether oxidizing or reducing.

Fe_2O_3 heated above 1100° C. in air gives off oxygen; and as the temperature is raised, Fe_3O_4 (magnetite) is finally produced, which melts about 1538°, according to O'Ruff. On the other hand, Fe_2O_3 or Fe_3O_4 heated in a reducing atmosphere gives ferrous oxide (FeO), melting at 1419° C. (O'Ruff). Fe_2O_3 does not readily react with silica, while FeO forms an easily fusible compound with silica. The reaction of Fe_3O_4 is not definitely known. On the other hand, Fe_2O_3 and lime react to form easily fusible compounds at 1200° C., which greatly reduce the refractoriness of a clay.

The effect of atmosphere on the properties of a refractory containing iron is by no means satisfactorily solved, and the Gas Engineers' Specification, which says refractories are to be tested in an oxidizing atmosphere, is not sufficiently explicit, as it is quite probable that an atmosphere containing some oxygen may not prevent the reduction of iron compounds. It will depend on their oxygen dissociation pressures, &c.

(6) *Titanium Compounds.*—These usually occur to the extent of not more than 2 p.ct. in the form of TiO_2, $TiFe_2O_3$, $TiCaO_5$.

According to Reike, TiO_2 melts at 1610° C.; but titanium compounds combine with silica or alumina and lower their fusion-points, and are therefore undesirable.

(7) *Lime Compounds.*—These usually occur as carbonates, sulphates, double silicates. The carbonate loses its CO_2 on heating, forming CaO, which has a melting point above 2450° C. (O'Ruff). Lime, however, readily forms easily fusible silicates or aluminates.

Calcium sulphate (hydrated), gypsum, loses water when heated, and at 1200° C. decomposes into CaO and SO_2 and O_2. In the presence of SiO_2, Fe_2O_3, &c., it will be found to decompose more readily.

(8) *Magnesium Compounds.*—Magnesium occurs in clays chiefly in the form of carbonate, which when heated gives off CO_2 and leaves MgO. Magnesia behaves very similarly to lime in forming easily fusible compounds with silica and alumina, but is said to be slower in its action. Magnesia itself fuses at a temperature above 2500° C., according to Ruff and Sieferheld.

(9) *Alkali Compounds.*—These usually occur in clays as insoluble alkali-alumino-silicates of low fusion-points. Occasionally alkalis are present as soluble salts, which when heated melt and vaporize and have a serious fluxing action on the clay substance.

EFFECT OF HEAT ON MIXTURES OF CLAY CONSTITUENTS.

Alumina and Silica Mixtures.—According to Seger, mixtures of alumina and silica have the following squatting-points:

Al_2O_3. P.Ct.		SiO_2. P.Ct.		Squatting Point.
100	..	—	..	2000° C.
82	..	18	..	1920
62·9	..	37·1	..	1850
50·5	..	49·5	..	1790
40·4	..	59·6	..	1750
29·7	..	70·3	..	1710
17·5	..	82·5	..	1650
10·1	..	89·9	..	1610
8·4	..	91·6	..	1670
6·5	..	93·5	..	1710
—	..	100	..	1770

The addition of silica to alumina depresses the melting point of the mixtures lower than that of the arithmetic mean of the melting points of silica and alumina. The mixture 10 p.ct. alumina and 90 p.ct. silica has the lowest melting point, and is called the "eutectic" mixture.

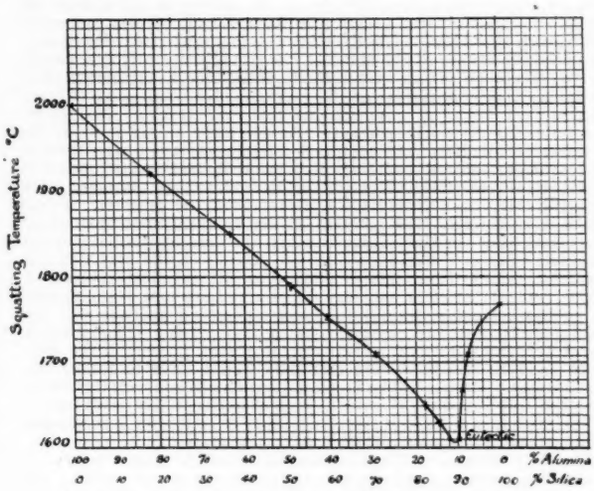


Fig. 1.—Refractoriness of Alumina-Silica Mixtures (Seger).

If silica is added to a fireclay it tends to lower its refractoriness, and the explanation is forthcoming in the above table, which also shows that a jointing material composed of clay and silica is likely to cause trouble when used for silica-brick setting.

FELSPAR-QUARTZ-KAOLIN MIXTURES.

When we come on to mixtures of these constituents, the problem becomes extremely complicated, and, besides possibilities of new compounds and varying mutual solubilities in liquid and solid state, involves several binary eutectic mixtures as well as

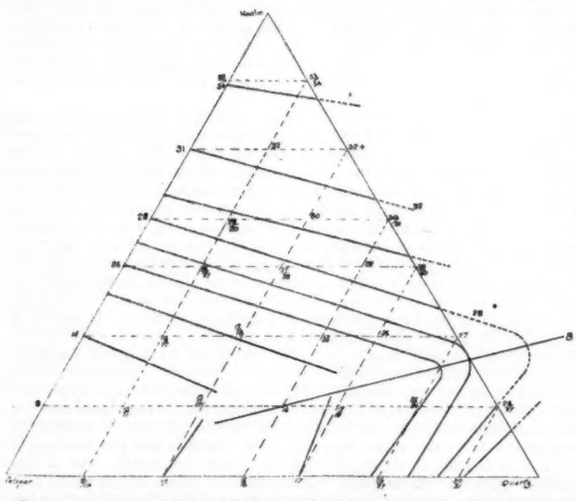


Fig. 2.—Refractoriness of Felspar, Quartz, and Kaolin Mixtures in terms of Seger Cones.

one or more ternary eutectic mixtures. Metallurgical chemists are familiar with this problem in alloys, and will recognize the use of the triaxial diagram for representing such mixtures.

The above diagram* for felspar-quartz-kaolin mixtures was constructed by Purdy from results obtained by Simonis. The line A B passes through the binary eutectics of kaolin and quartz, and probably runs into the ternary eutectic of all three somewhere towards the corner A. This eutectic is not given, neither are those for kaolin-felspar, felspar-quartz.

One would gather from this diagram that fluid mixtures above the line on cooling very slowly would deposit kaolin until the eutectic axis was reached, and, on further cooling, then the quartz-kaolin eutectics would be deposited until the ternary eutectic was reached, when the remaining fluid would solidify at constant temperature.

The two foregoing examples of the behaviour of comparatively simple mixtures give some idea of the complexity of the reactions which occur in heated refractories, and with which users and makers have to contend.

EFFECT OF HEAT ON FIRECLAY ALONE.

When a mass of dried fireclay is gradually raised in temperature, the following changes have been observed by Mellor and others. Colloidal silicic acid decomposes at about 200° C. and moisture is evolved; and on nearing 500° C. the alumino-silicic acids decompose, producing steam, free Al_2O_3, and SiO_2. Up to this point the clay has contracted slightly, but above 500° C. there is a slight expansion, followed by a steady contraction when the alumina begins to polymerize about 800° C. At 1000° C. such fluxes as felspars start to fuse and dissolve the other constituents, and the main contraction sets-in as the fused material tends to draw the more refractory grains closer and closer together. At 1200° C. alumina and silica combine to form sillimanite, and at 1500° C. the clay sinters to a stone-like mass.

If the clay is low in fluxes, the fluxes will soon become saturated with alumina and quartz and form a viscous solution, which is practically infusible at the given temperature. If, however, the mass is raised to a higher temperature, the viscous solution becomes fluid again and continues its work, dissolving the more refractory grains and pulling the grains into closer contact. This is what happens to bricks in retort-settings if the temperature is higher than that at which the brick was "burned." It is important to note that the extent to which the above phenomena occur depends both on rate of chemical reaction and rate of solution and, consequently, on time and temperature.

Use of Grog in Brick Manufacture.—In order to reduce to manageable dimensions the trouble caused by the drying shrinkage and subsequent fire shrinkage of fireclays, it is usual to mix them with a non-plastic, non-shrinking material, such as grog. This addition also gives the finished article a more porous texture and enables it to withstand rapid changes of temperature without cracking or spalling. The quantity of grog that can be added is limited by the fact that it reduces the strength of the refractory. The grog acts as a kind of skeleton about which the fireclay sinters. Generally speaking, the best grog to be used is that made from the clay from which the article is being made, after the clay has been burned for a sufficient time to take out all the fire shrinkage. The burned clay is crushed to grains usually less than ¼ in. and then graded. This graded material constitutes grog.

The firebrick must be burned at a sufficiently high temperature, and for a sufficient time, to take out practically all the fire shrinkage. Generally speaking, firebrick should be burned at a finishing temperature of Cone 14 (1410° C.), or higher; but many manufacturers do not go so high owing to the increased cost of production involved by the use of more fuel. The goods should really be fired at a higher temperature than that they will attain when in use.

Silica Bricks.—These are generally manufactured from suitable crushed silica rock properly graded and mixed with some bonding material such as a small percentage of suitable clay or 1 to 2 p.ct. of lime. When the bricks are burnt, this bonding material forms a flux with the silica and binds the silica grains together in a glassy matrix. The fireclay bond appears to be stronger than the lime bond, and gives the best results. Many natural silica rocks (or rather siliceous rocks) contain sufficient clay to require no additional bond. The burning of silica bricks should usually require 9 to 12 days, and the kilns should finish at 1435° to 1500° C. or even higher (Cone 15-18). The burning must be sufficiently sustained to take out practically all the expansion—*i.e.*, to convert the bulk of the quartz into cristobalite and tridymite. Unconverted quartz varies from 25 to 45 p.ct.

The rate at which this inversion takes place is effected by the nature of the bond—lime increases the rate considerably. The natural silicas invert at different rates—*e.g.*, flint silica inverts much more quickly than quartz, and the natural silica depends largely on this factor, because it is uneconomical to burn those of slow inversion rates. The texture of a silica brick shows a mass of crystalline grains surrounded by a glassy matrix, more or less coloured yellow by iron. Traces of slag and Fe_3O_4 are also usually visible. By the use of the polarizing microscope, the crystalline grains are seen to be composed largely of tridymite and cristobalite and some unaltered quartz. Generally speaking, the larger the proportion of tridymite and cristobalite, the better the brick will prove in use. A very slight amount of expansion of silica bricks when in use is not altogether objectionable, as it tightens up the joints.

Properties of Fireclay and Silica Bricks.—Although the ordinary analyses of the unburned and burned bricks are not very different, most of the mineral constituents of the fireclay have undergone a complete change during firing, and the clay has completely and permanently lost many of its characteristics, such as its plasticity,

* This method of graphical representation of results may be briefly explained as follows: The sum of the perpendicular distances from any point within the equilateral triangle to the three sides is constant and equals the perpendicular distance from an apex to the opposite side. The apexes represent 100 p.ct. of quartz, kaolin, or felspar respectively, and the opposite side zero per cent. To determine the composition represented by any point in the triangle, note the perpendicular distance from each side, and this represents the percentage of constituent at the opposite apex.

Many of the original compounds have decomposed or changed their state, and many new compounds have been formed. The physical properties of refractories are largely dependent on the nature and size of grain of the original material, but are also influenced by the processes of manufacture—such as grading, proportioning, mixing, moulding pressure, correct burning, &c. The surfaces should be smooth and the size and shape accurate, as on these depend the making of good tight joints. A good skin helps resistance to slag penetration. The texture should be uniform, otherwise serious strains will be set-up in use and the easy ingress of harmful vapours allowed. The coarseness of texture desirable depends largely on the use to be made of the brick, and this also largely determines the porosity.

The specific gravity of firebricks is round about 2·6, and that of silica bricks about 2·3.

The specific heat of firebricks according to Wilson and Holdcroft rises from 0·232 at 700° C. to 0·264 at 1300° C. That for silica brick is about 0·26.

The rate of heat transmission of firebricks usually averages about 0·0035 gram-calories per second per square centimetre per cm. thickness, with a temperature difference of 1° C. It is commonly stated that silica bricks are better conductors than fireclay bricks; but, although this may be true, the evidence so far forthcoming does not support the superiority of silica in this respect. At high temperatures, according to Mellor, porous bricks are better heat conductors than those of dense texture. The radiation across the pores is greater than conduction by the solid material at high temperatures.

The Fusion of Bricks.—Fireclay goods have no well-defined fusion temperature, but soften over a considerable range, as one would expect from their complex composition. Silica goods, however, stand somewhat higher temperatures than fireclay, but squat suddenly over a narrow range. The fusion-test in a clean atmosphere does not enable one to forecast with any certainty how a firebrick will behave under industrial conditions. A brick with a dense texture will often prove more durable than a porous brick with a higher fusion-point. For this reason the behaviour of bricks when heated to high temperatures under a load or pressure is considered more useful for indicating its quality, as the resistance to load at high temperatures depends among other things on texture as well as composition. Bricks containing a considerable amount of vitrified matter will stand greater load in the cold than those with less; but at high temperatures the reverse of this is generally observed, as the cementing fluxes soften and allow the bricks to collapse. Good silica bricks will stand greater load when hot than firebricks, but when they do collapse it is much more sudden. This property of silica is a strong point in its favour. The strength of bricks at high temperatures can be increased or decreased by careful adjustment of the proportions and sizes of the ingredients.

For gas-works purposes straightforward refractoriness would not be very difficult to guarantee, but the whole problem is complicated, due to the interactions which take place between the refractory material and the gases, vapours, and fluxes produced in gas-works carbonization processes. Many of the constituents of coal ash readily combine with the silica, &c., forming low melting-point fluxes which dissolve away the material. Alkalies in the coal vaporize at high temperatures and diffuse into the refractory through the pores or bad joints, and flux away the refractory, or cause it to grow or expand and break away or spall. Hydrocarbons, &c., reduce the iron in the material, in which state it readily fluxes with the silica. Carbon is deposited in the material and alters its properties. The action of superheated steam requires investigation.

Under steaming conditions in vertical retorts it is possible that the coal ash has increased opportunity of attacking retort walls, partly due to the thinner scale, and partly due to exposure of the ash as the carbon is consumed by the steam. A similar effect is obtained in water-gas generators, where slagging action on the refractories is a serious item.

The manufacturers' difficulty is that while a close-grained texture is best for overcoming these troubles, a coarse-grained texture is necessary to enable the material to stand temperature changes.

CONCLUSION.

While testing refractories we have been very much impressed with the variations in quality of material supposed to be of uniform grade; and the necessity of both user and maker paying far greater attention to the quality of refractories, in the writer's opinion, cannot be too strongly urged. Seeing the extensive use our industry makes of refractories, and the grave results which occur if they break down, or the serious losses involved if they have to be run at lower temperatures simply to nurse them, there seems every argument for the above suggestion being more generally adopted; but the number of works buying their material to specification, and, what is more important, seeing that it is up to specification by careful testing, is decidedly small. Similarly, apart from a few enlightened manufacturers, very little real testing is carried on by the makers. Central testing laboratories are needed.

The variations in the quality of the raw material are much greater than is commonly recognized; and this is one factor which calls for very careful watching and continuous testing and supervision on the part of the manufacturer. Well-informed technical control requires to start in the mine or quarry, just as in analyzing a substance the sampling has to be most carefully and intelligently done, otherwise the result is useless. The refractories specification of 1911 was a big step forward; but it is very badly in need of revision in the light of knowledge and experience accumulated since then. With a revised specification reasonably to meet all present-day requirements, and gas engineers buying to that specification, much better or more uniform material would doubtless result.

It is only fair to add, in what pretends to be an unbiassed opinion on the subject of the quality of refractories, that scientific men have still a great deal to discover about refractories. But surely this shows the urgent need for increased research on the lines of the invaluable fundamental work being carried on at Stoke, Leeds, Sheffield, and elsewhere. There are possibilities of great advances being made in the manufacture and proper use of refractories, as well as the introduction of new ones, if the greatest possible co-operation between maker, user, and physical chemist is encouraged.

The PRESIDENT said Mr. Rhead's contribution was one of special interest to the gas industry.

Mr. J. W. WOOD (Fuel Department, Leeds University) pointed to the importance of a consideration of the subject of refractories by mentioning that in nearly every case the gas engineer was concerned with goods that had been fired, at any rate to a moderate temperature; the previous history of the material was all too frequently overlooked. It was no use buying to specifications unless one knew something of the individual constituents of the product. No doubt some of them might have heard of modifications that were taking place in refractories for gas-works practice. At one large works some of the settings were built up with unburned refractories, which were fired in the settings. Mr. Rhead had very properly laid stress upon the question of the colloidal condition as influencing plasticity. He thought this was a reasonable explanation of the position. A few years ago, however, the question of the colloidal state was never discussed, even on the academic side; the loss of plasticity being then put down to dehydration—loss of water from the clay. It was customary in the laboratory to make frequent chemical analyses of clays; and while not in any way saying anything that would appear to belittle chemistry, he did not think a chemical analysis was the real analysis that was required. What they needed to know more about were the individual constituents that were present in the firebrick; and it seemed to him that they would have to follow the metallurgist. He would like to ask a question: If one were limited to time and had a number of consignments of bricks to test, what would be the minimum amount of testing necessary to enable an approximate judgment as to the quality of the bricks to be made?

Mr. W. J. PICKERING (Birmingham) described the paper as one of compelling interest to gas engineers and gas-works chemists alike. All realized the importance of refractories, because upon them the gas engineer had to depend. It was all very well for engineers to carry out testing on a large scale; but what about the engineer who could not avail himself of that? He had to rely upon the manufacturer. There was much scope for improvement in this direction. He would like to ask a question as to fluxing action. How was it that sometimes, with modern hot-patching cements, although they were able to stand up to a very high temperature alone, the patching, when in position, failed, with resultant injury to the retort and the one below?

Mr. C. F. W. RENDLE (Redditch) agreed it was of the first importance that gas engineers should pay special attention to refractories. He was under the impression that it was an accepted American practice to use silica retorts, one of the reasons given being that the rate of heat penetration was much greater than in the case of ordinary fireclay retorts. The action of certain compounds of flue gases on refractory materials in accelerating fluxing would, he supposed, be confined to the exterior; but he would like to know whether this action was cumulative and then proceeded to the whole mass, or whether it was confined to the skin.

Mr. RHEAD, replying on the discussion, said as to the minimum testing necessary in a consignment of refractory material, he wished he knew himself. Obviously, so much depended upon the quality of the refractory a manufacturer was turning out. Naturally in a product in which the quality was more or less uniform the amount of testing required would be materially reduced. Their own experience was that the quality varied materially from kiln to kiln; and this fact necessitated a large amount of testing, to avoid the use of inferior material. As to Mr. Pickering's question, he thought if gas engineers would test their material or have it tested at some central station, they would get much more uniform products. There would also be an incentive to the manufacturer to produce material of a uniform quality. It would be interesting to know what happened to rejected material. As to why hot patching cement might possibly stand up to a good temperature by itself, but when placed in the retort behave differently, there appeared to be two explanations: (1) It might contract excessively and allow coal-gas flames to get through, thus creating intense local heating and immediate fluxing. Or it might be (2) that it was of a different composition from the retort material with which it was placed in contact, in which case it might form a flux with the retort. As to Mr. Rendle's question about heat transmission of silica bricks *versus* fireclay refractories, possibly the former were used largely in America for the reason of high heat transmission. He would not say that they did not transmit the heat better; but the evidence was not conclusive on the point. In America, it was the practice to work to a higher temperature in the coke-ovens than in this country, and silica material helped them to do this. As to the action of fluxes on the outside of the retort, and the possibility of penetrative mischief, it seemed to him probable that if the temperature were kept constant the action might stop after a good glaze had formed. After cooling, however, the skin that was formed might crack and allow the mischief to continue, and this probably happened in coke-oven walls. The glaze formed had properties different from the brick itself, and when the coke was pushed out spalling of the brick might be caused. It was a common practice on the Continent to glaze retorts to prevent the diffusion of gas or alkali vapours into the mass of the material.

A VISIT TO THE OLD KENT ROAD.

By the London and Southern District Junior Gas Association.

But one feeling of regret was in the minds of the hundred or so members of the London and Southern District Junior Gas Association who last Saturday afternoon assembled for an inspection of the Old Kent Road Works of the South Metropolitan Gas Company—and that was the absence of their respected President, Mr. Frederick A. Frost. The South Metropolitan being Mr. Frost's Company, it was known that he had looked forward to this visit as one of the principal events of his year of office; and keen sympathy was felt with him in his disappointment at enforced absence through indisposition. Many of the members present on Saturday had taken part in one or more of the previous inspections of the works—the last of which was two years ago—but they were just as eager as those who had not been before to Old Kent Road to see and hear the many interesting things that are always to be learned on these works.

On arrival, the visitors were received in the vestibule of the chief offices of the Company, by Mr. C. F. Franks, who deputized in the absence at that stage of the proceedings of Mr. G. M. Gill, the Chief Engineer. It was explained that the parties would be divided up into three groups, any one of which the members were at liberty to join. The three groups were for those chiefly interested in manufacture, distribution, and chemical matters respectively. Each party took the same route (which had been previously mapped out), but spent most time in its particular section of the works. It was a very good arrangement; for in this way each member was able to devote the maximum part of the two hours available to a study of those matters which were most likely to be of practical use to him. The duties of guides were efficiently undertaken by Messrs. Sims, Grosse, Payne, Mitchell, Simmonds, Everett, Hart, Hewett, Hollings, Blow, and Palmer.

With regard to the carbonizing arrangements at the works, it was pointed out that each of the four retort-houses at work contains sixteen settings of ten retorts; the make of gas averaging about 14,500 therms per house, with an aggregate capacity of 58,000 therms per day. The retorts are 20 ft. long and of oval cross-section, measuring 21 in. by 15 in. inside. The average charge of coal per retort is 10½ cwt.; and this charge is carbonized in ten hours. Producer gas is generated in outside producers, two to each house, having a capacity of 40 tons each of coke; the coke used per day being about 35 tons per house. The calorific value of the gas is approximately 120 B.Th.U. gross; and the analysis averages 29 p.ct. carbon monoxide, 4 p.ct. carbon dioxide, and 8 p.ct. hydrogen; while the waste gas averages 19 p.ct. carbon dioxide and 5 p.ct. oxygen. The waste gas on its way to the shaft imparts some of its heat to the incoming producer gas, and also to the secondary air, thereby effecting heat recovery. The average temperature of the combustion chambers is 1300° C.

Each house is worked on the unsealed dip-pipe system, in which the level of the liquor in the hydraulic main is maintained at ½ in. under the bottom of the dip-pipe; provision being made for sealing in the usual manner when the retort-house is shut down on Sundays, or put on slow fire. No anti-dip apparatus is used. The pressure or vacuum is maintained by the retort-house governors. The latest addition to this system of working is the dividing-up of the sixteen settings in each house into units of four settings. Each unit has its own governor; and when charging or discharging takes place, the particular unit only is affected by a reduced vacuum which is maintained while the doors are open. The governors are weighted from the stage by means of a wire cable. It is proved by results obtained that the gas thus made is not only of good quality, but the make per ton is also increased. The inerts are maintained at from 8 to 10 p.ct., the gas made per ton at about 71 therms of 550 to 560 B.Th.U. gross, and the make per retort at 88 therms. Coke made for sale is 10½ cwt., tar 9 to 9½ gallons, and liquor 40 gallons of 8 oz. strength. The houses are frequently put under pressure of ½ in. in the foul main, in order that all bad doors and other leaky joints may be rapidly detected.

The retorts are charged with coal by West's compressed air charging machines working at 60 lbs. per sq. in. pressure; and the coke is ejected by "Hunter-Barnett" hydraulic pushers working at 625 lbs. per sq. in. pressure. Before entering the holders, the gas passes through horizontal rotary washer-scrubbers, containing anthracene oil, by means of which the whole of the naphthalene is extracted.

The inspection over, the visitors found tea awaiting them; and afterwards Mr. Gill addressed them on some points of practical interest.

Mr. D. C. CROSS (Lea Bridge) voiced the regret of them all at the absence of the President, for whom they felt extremely sorry. He commented upon the way in which everything had been thrown open and explained to them, and said the Company were out to benefit the industry in every possible way. There was always something fresh to be learned on these works. The retort-houses were as perfect as could be, and showed how the wonderful results of the Company were obtained.

Mr. W. NEWTON BOOTH (Woolwich Arsenal) proposed a hearty vote of thanks to the Directors of the Company, to Mr. Gill, and to the various guides, for the way in which they had received and entertained the Association. He said he was greatly impressed with the work the Company were doing. They were right in the forefront of gas making and supply in this country.

Mr. LEONARD LACEY (Gas Light and Coke Company), seconding, remarked that he had been much struck with the good condition of the retorts, which he believed were of fairly considerable age. When working at a vacuum in the retort itself, this was, of course, of great importance.

PRACTICAL POINTS IN MANUFACTURE.

Mr. GILL said that, on behalf of the Directors of the Company, he thanked them very much indeed for the vote which had been so ably proposed and seconded and so cordially passed. Speaking for the Directors, he could assure the members of the Association that they were only too willing at any time to throw open their works and plant for inspection. The attitude which was always adopted by them was that if there was anything they could do to assist the industry and the members of the industry, they were only too glad to do it. On behalf, also, of the guides, he thanked the speakers for the kind remarks which had been made. Their assistance had been most readily given. At the present time, there was much of interest and importance happening in the gas industry; and perhaps the visitors would bear with him for a few minutes while he pointed out one or two matters which might usefully be taken into consideration by them, and which had forced themselves upon the attention of his Company.

THERMS AND INERTS.

Naturally, they had tried hard to get as many therms as possible from a ton of coal; and he had proved to his own complete satisfaction that to do this they must as far as practicable exclude inert gases and air. This meant that they must keep their retorts as tight as they could. Holes and cracks were apt to show themselves in retorts; and it was essential to repair and keep on repairing retorts, and never to allow a hole or crack to be overlooked when retorts were discharged. When a retort was first charged, there was a glut of gas coming forward; and if there were any cracks or holes in the retorts, a certain amount of this gas—which was the richest gas that came from the coal—leaked out into the setting. Then later on in the charge waste gases were drawn into the retort through the holes by means of which the rich gas had previously passed out. In this way, some of the good gas was lost, while the poor gas was increased. Exactly the same thing happened with leaking retort mouthpieces and lids, except that air was substituted for products of combustion. The thing to do, therefore, was to have the mouthpieces and lids faced when opportunity offered, and then keep them clean while at work. This, in his opinion, was the chief secret of obtaining a good quality of coal gas and a high yield of therms per ton of coal.

PERCENTAGE OF OXYGEN.

Possibly some of those present had had experience with rusted service-pipes; and it would be a very bad day if the naphthalene stoppages of the past should be generally replaced by rusted services, for the naphthalene could be dissolved while the rust could not. He would suggest to those of them who did not do so already that their gas should be tested night and day. In a small works, no doubt, this would be difficult; but even there, one could take a continuous sample of gas during the night, and test it during the day for oxygen, which was likely to cause great trouble unless severely restricted. For the rusting to which he had referred, oxygen was largely responsible. His Company had made a point of keeping the oxygen as low as possible, and considered that 0·3 p.ct. in the gas should be regarded as the maximum.

UNIFORMITY IN QUALITY OF GAS.

Probably there was nothing which was more appreciated by consumers than uniformity in the quality of the gas supplied to them; and he would go further and say that no company who were not supplying a uniform quality of gas within practical limits could pride themselves upon giving good service to their consumers. It was not at all easy to keep the gas uniform in quality; and he knew of no alternative to the absolute necessity of testing the make, or at any rate the district supply, at frequent intervals both day and night. The man responsible for making the gas could not keep it uniform if he was working in the dark. He must know the quality he was making; and this meant testing. Fortunately there were some recording calorimeters now being put upon the market; and so long as such instruments were frequently checked against a non-recording calorimeter, and their inherent defects were recognized, it might be considered that they had placed within the hands of gas makers something really helpful to the maintenance of a uniform quality of gas. He believed it was the practice of his Company to test them every four hours, or something like that, against a Boys instrument.

MIXING GAS IN THE HOLDER.

Another measure which his Company had taken in order to get the gas as uniform as possible was to refrain from working in and out of gasholders. They put the gas in one holder, while they supplied the district from another. In this way, they were always getting a mixing effect in the holder. He did not think this was general practice; but it was certainly very good practice.

LOW-GRADE GAS.

A good deal was heard from time to time of the advantages of supplying low-grade gas. As they knew his Company supplied what was regarded as being a rather high quality; and there were

undoubtedly many advantages in doing so. If with low-grade gas a therm could be made much cheaper than a therm of high-quality gas, proper consideration must, of course, be given to the matter; but the great advantages of distributing a concentrated commodity instead of a diluted one must appeal to a practical mind. When they reflected that the size of their whole plant, from the foul main in the retort-house to the burner on the consumer's premises, was dependent upon the volume, as distinct from the thermal value, of the gas which had to pass through it, the great advantages of the higher grade gas must be apparent. The benefit of sending out a gas in more concentrated form must have impressed itself upon some of the members, when dealing with the demand for gas at cooking time on Sundays and on Christmas Day. After all, it was therms, and not cubic feet, which they had to supply to the farthest points of the district—and often a very great many therms in a very short time. His own belief was that, as time went on, the tendency would be towards increasing the calorific value of the gas supplied by undertakings, and not reducing it. If, for instance, the question was looked at from the point of view of capital expenditure, it would be seen that the value of a gasholder, which held so many cubic feet, was decreased or increased in proportion to the quality of gas that was put into it. One could store in the same number of cubic feet a great many more therms of 550 B.Th.U. gas than would be possible with 450 B.Th.U. gas; and it was therms that they wanted to store.

Moisture in Coke.

Another matter to which a few moments' consideration might be devoted was the condition of coke as sold to customers. Some of them had been rather apt to complain that they had had difficulty in getting rid of their coke; and no doubt this arose partly from its condition, to which not sufficient attention had been paid in the past. His own Company had of late been devoting themselves to reducing the percentage of moisture in the coke, and had every reason to think that they would be able to do so very substantially. Frequently not nearly enough trouble was taken to have the coke quenched with a minimum of water; and to anyone present who was of an experimental turn of mind, he would suggest that he should have some coke quenched under his own supervision with the minimum quantity of water, and then have it tested for moisture. It would be surprising to find how little moisture the coke would contain. They could not afford to give anything away in the matter of coke. It had to have the whole of the ash that was originally in the coal, which meant something like 50 p.ct. more ash than in the coal from which it was made; and if, added to this, there was a lot of moisture, it made a poor fuel of the coke. Many of the modern coke-handling plants, designed simply to save labour, compared very badly indeed in respect to breakage and quenching with the old-fashioned barrow and bucket of water.

Refractory Materials.

The last matter upon which he would touch was that of the quality of refractory materials supplied for building retort-settings. This was another direction in which he thought those concerned with the management of gas-works should turn their attention. He had been looking into this question, and had come to the conclusion that quite a small proportion only of the refractory materials supplied to gas-works came up to their requirements. It should be remembered that such materials had to withstand in a retort-setting, not only temperature, but also load; and that was where they failed. They could stand either the temperature or the load; but they could not stand the combined temperature and load. It was quite an interesting thing to examine one's old retort-settings when they were being pulled out, and measure some of the bricks and blocks. It would then be found that many of them had shrunk considerably. The refractory materials softened at the working temperatures of gas-works, under load, and so gradually let the settings down. The retorts and bricks and blocks built in the settings directly over the combustion chamber should be made of a material which, at the temperature at which it had to work, did not soften under the load which it had to support. They were, of course, in the hands of the refractory materials makers, who carried out their work by rule-of-thumb. In fact, the maker of retorts and fire-bricks was in the same position to-day as were the cement makers 25 years ago, when they were gradually losing their trade to foreign competitors. The cement makers then saw what was happening, and some enlightened people took charge of the industry, and introduced a proper system of control of their process from beginning to end, with the result that they knew now exactly what their product was going to be, and up to what tests it would stand. This was what was wanted in the refractory materials industry.

In conclusion, he assured the Association that whenever they wanted to see any of the South Metropolitan stations, he had no doubt that the Company would at once fall in with the proposal.

Mr. Cross thanked Mr. Gill for his extremely helpful address. Whenever Mr. Gill came to any of their meetings, he opened his heart to them. His remarks were among the most valuable that had ever been addressed to the Association.

An adjournment was then made to the gymnasium near by, where arrangements had been made, as on the occasion of the last visit, to entertain the visitors with an excellent boxing and "jiu-jitsu" display. This item of the programme had again been organized by Mr. A. Coleman, well known in the wrestling world.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Works of General Gas Appliances, Ltd.

The members of the Manchester and District Junior Gas Association visited the works of General Gas Appliances, Ltd., at Guide Bridge, Manchester, on Saturday last. The party assembled in the offices of the Company and Mr. W. R. Francis (Director) extended to them, on behalf of the firm, a very cordial welcome, and remarked that they had great pleasure in bringing to their notice what had been done by the Company during the last fifteen months.

The firm commenced in 1919; their works covering an area of 4½ acres. The Company was formed to acquire the Planet Foundry Company (Gas Stove Department). The works comprised a general stores; polishing shed complete with emery wheels, buffing machines, and dust extractors; template shop; assembly shop; spraying plant and stoving rooms; core making shop, and foundry; pattern shop, &c. A railway siding runs direct into the works, and all goods can be packed under cover, as the siding forms part of the warehouse. There are also two chemical laboratories for the testing of stoves and the efficiencies of gas fires, cookers, &c. All the shops are extremely well lighted and work is carried on under ideal conditions. The plant is driven by electricity supplied by the Manchester Corporation.

The party then proceeded round the works, being conducted by the following gentlemen, who acted as guides: Messrs. W. R. Francis, S. C. Whitfield, W. H. Locke, W. Torkington, J. Townsley (Directors), and Mr. Dixon (Chemist).

An Interval for Tea.

Tea was served in the offices of the Company, after which

Mr. Bridge (Elland), at the call of the President, moved a vote of thanks to the firm for their hospitality, and referred to the excellent workshops they had just visited, and also the very efficient gas appliances, upon which the success of an undertaking very often rested. The President had remarked to him that afternoon that more attention might be given to the district in which any particular piece of apparatus was supplied, so that it might be tuned to suit the gas and the usual pressure, and so obtain the highest efficiency possible.

Mr. Massey (Oldham) seconded, and thanked the firm for their kindness to them that afternoon. He had known the Directors for a number of years, and wished them success in their business, which, though young, gave great promise of being a very big concern, as there was ample room in their workshops for a large volume of trade. They were out to supply really good appliances; and it was up to undertakings to buy only the best apparatus.

The President supported the resolution, which was carried with applause.

Mr. W. H. Locke (Secretary and Director), in reply, said they appreciated their vote of thanks, and also the honour of the visit. They were only a young Company; but they were perhaps better known outside the district than they were in it, as was often the case with industries like theirs. He mentioned the difficulties of making appliances when, as had been mentioned by the President, gas undertakings supplied gas varying in quality every day. He gave an instance of a three days' test in one district where they had been, and had found 465, 481, and 458 B.Th.U. respectively, besides different percentages of carburetted water gas. Again, when they considered they had to cater for (say) about 4000 undertakings, it was a rather big task. Gas undertakings, he thought, were coming more into line, and were out for the making of a standard gas. When they had a universal standard, then their difficulties would almost vanish.

Mr. Whitfield said they were proud of their works, and were out to do as well as anyone else, and to make appliances to suit all qualities of gas.

Mr. Francis supported.

The Business Meeting.

At the conclusion of the tea, a paper was read by Mr. D. T. Livesey, on

CARD SYSTEM RECORDS IN THE DISTRIBUTION SYSTEM.

When asked by our President in the early part of his year of office for a paper on some phase of distribution, the only subject I could think of at the time as a likely one was that of card system records in the distribution department.

I think it will be agreed that, in the commercial department of any modern business, one of the most striking features of the various offices is the presence of cabinets of varying sizes containing card records of the many sales or other activities of the business. Once considered a new-fangled and superfluous accessory, this system of keeping records has grown so essential to business life, and has assumed such proportions, that there are many firms who specialize in producing it in forms varying according to the nature of the business in connection with which it is to be used. Its greatest advantages are, to my mind, its flexibility and (once the arrangement of the cards is decided upon) the ease with which any required record can be found when necessary.

The advantage of its flexibility is particularly appreciable in the distribution department of a gas undertaking, where constant records of one kind or another have to be made and kept of work done, gas used, fittings inspected, &c. In former days, and even now in some cases, these records were entered up by the various

inspectors, fitters, &c., in books in which the consumers' names appeared in the order which the inspector would follow to save as much walking as possible in his rounds of the district. It is true that the old-fashioned books had the one advantage that the information it contained was always kept together, and there was no question of losing odd cards; but who of those who have used this method have not found at some time or other that reference was needed to some particulars in the book, which could not be obtained immediately, because the book was at the extremity of the district in the hands of some one engaged in obtaining or checking other particulars? It may be objected that this might similarly apply to cards, but with the latter only those cards actually needed are taken out by the inspector, and all others are left in the office for immediate reference, in charge of some responsible person; whereas with the books, the whole book goes out, probably containing scores of records besides those which are being immediately followed up.

Another disadvantage of the old-fashioned books was that of the inability to insert the names of new consumers or new subjects for record in the order in which they could most economically be dealt with, without either pasting in fresh pages or adding them at the end of the book in spare pages with reference numbers to enable them to be traced. The very fact of having to keep so many spare pages available for possible eventualities is in itself uneconomical. With a card system, the record of any new consumer, or any additional subject, could be inserted with the greatest of ease in the order in which it would be treated.

I well remember the difficulty I once had, when taking charge of the mains and services of a gas undertaking in a hilly district, of following the process of the regular emptying of the so-called syphons, or condensed water drip-pots. The book used by the man responsible for this periodic duty of pumping the syphons may have been originally made out with the syphons entered up in "walking order;" but new syphons were entered as new mains and services were laid, and by the man who laid and pumped them. It was hardly to be expected that his book-keeping was good; but it was simply impossible to find the record of any particular syphon without going through the book page by page. Cards were obtained—blue for main syphons, and white for those on services. On these were entered the size of mains, and particulars of the exact position of the syphon relative to given points most likely to be of a permanent nature. The need of these latter particulars was impressed on me by the discomfort, in the depth of winter, of scraping about at night in the snow searching for syphon and pressure-taking standpipe covers in the roads in country districts. On these cards were entered (as and when they could be ascertained) the exact particulars of the shape and size of the main's syphons, so that from the marking of the dipping rod one had an idea what water had to be contended with.

The use of cards by the Stretford Gas Company was the most extensive I have personally been associated with in the distribution department. From what I have heard, however, at the meetings of our Association this session, I gather that there are members whose undertakings have more comprehensive and elaborate systems in operation; and I now regret having chosen this subject. But having done so, I will describe such cards as we have used, by way of introducing the subject for discussion, and, by this means, eliciting some information as to how far the system can be efficiently elaborated and further used for the benefit of gas undertakings, especially in these days when gas salesmanship is a subject that is receiving so much attention.

In connection with our Distribution Department, we have a series of 11 cards differing in shape and size as most suitable for the rulings necessary for the records kept. Difference in colour, as well as in shape, enables ready distinction between the cards. The cards in use are for records as follows:

(1) Meter record	6 in. by 4 in.
(2) Ordinary meter reading and watering	"
(3) P.P. watering	"
(4) P.P. reading	"
(5) Cooker hire	5 in. by 6 in.
(6) Fire hire	"
(7) Radiator hire	"
(8) Cooker inspection	6 in. by 4 in.
(9) Fire inspection	"
(10) Griller inspection	"
(11) Incandescent burner maintenance	"

(1) The first (for meter records) is a white card 6 in. by 4 in. in size. Each meter as purchased is entered on one of these cards, on which particulars of size, description, date, Company's badge number, maker, and maker's number are given. Underneath these are rulings for particulars as to where the meter is fixed, the name of consumer, with dates of fixing and removing, and records of the date and result of testing, and the date and cost of repairs. Thus at a glance can be seen the whole history of any meter on the district from the time of its purchase. Further details of repairs would be got from the meter repairs book. These cards are filed away in the order of the Company's badge numbers. A small tab at the top of the card is printed with the size of the meter (3-light, 5-light, &c.); 3-light tabs being on the left, and tabs moving to the right with increase of meter sizes.

(2) The ordinary meter reading and watering card, 6 in. by 4 in. in size, is of a buff colour to distinguish it from the prepayment meter cards, which are white. These are filed in order of the route followed by the five meter inspectors, and are issued to the latter, by the clerk-in-charge, twice a quarter for the reading of the meters. The index, date of reading, and consumption are recorded; and every alternate reading wet meters are watered. In addition to these particulars, there are rulings for those of the service, meter, number of burners, and all apparatus supplied with gas through the meter. Thus at a glance can be seen the total apparatus for which gas is required through one meter. This is useful in case any complaint should be made regarding insufficiency of gas, as the relation of consumption to existing service and meter is readily seen. In order to keep this information up-to-date, particulars of the apparatus are checked every time an inspector is sent to investigate a complaint, or to take particulars of new apparatus required. As meter readings are entered on these cards, they are sent into the general office for entry into the rental books. When the cards are full, they are filed away in alphabetical street order, in case of further reference ever being required.

(3) Prepayment watering cards. These cards are used by meter readers for records of watering and checking of consumption. As in the case of ordinary meter cards, on this card are entered all particulars of apparatus supplied by the meter. If meters are exchanged—*i.e.*, ordinary for prepayment, or *vice versâ*—Nos. 2 or 3 cards are marked with the date of change, and filed away in the order of this date. This enables the record to be easily found should a change back again be required.

(4) Prepayment meter reading cards are ruled for meter readings, consumption, and cash collected. These cards are left, together with the receipt books, by the prepayment collectors after collection in the general office, where they are entered into the P.P. rental. The cash is paid to the Secretary each night and receipt books checked. Cash is checked against consumption every half year by the collectors.

(5), (6), and (7) The cooker, fire, and radiator hire cards are similar cards, and show the date of fixing of apparatus, size, and rental. Rental was on a diminishing scale, reducing from a maximum for the first year to a minimum in the fifth year, after which it remained the same. Cards were made out from the cooker, fire, or radiator in-and-out books, and entered up according to the rate in use at the time, and copied into rental. In the case of cookers, hire is charged quarterly. As fires and radiators are used mostly in the winter half year, hire is charged only at the end of the December and March quarters. The cards are distinctively coloured for the purpose of easy recognition of apparatus to which they refer.

A feature on the distribution side of the Stretford Gas Company was the inspection of apparatus such as grillers, cookers, fires, and radiators. The cards for these were entered up with particulars of the apparatus, and dates of inspection and repairs. This was done free of charge. Material only was charged for on cookers owned by consumers, or where there could be shown to be neglectful use or misuse in case of hired apparatus.

The system we have in our stores is to enter all goods on to cards showing the name of the article, its size and particulars, number of the bin in which it is kept, and its cost. Rulings are for date of receipt of goods, with the order number and quantity received. Then follow columns for entry of date and quantity issued from store, from which the balance in hand can be seen.

DISCUSSION.

Mr. BRIDGE (Elland) said the author had no need to apologize for his paper, in which he had introduced several new points. The card system offered many advantages; but if it was carried to excess, the labour-saving devices could soon cause expensive management charges. Cards for syphons, showing when they were pumped and giving the position and sizes of services, were very useful information.

Mr. CLEGG (Burnley) remarked that the card system was modern, and tended to efficiency, but should not be overdone. He was not impressed with the idea of meter inspectors taking out cards for the reading of the meters. He was very much in favour of consumers' cards, so that the cost of any special service could easily be ascertained. When all the particulars were put on one card, it enabled the undertaking to see whether the meter and the service to it were of ample capacity, as they all knew a consumer was often adding a gas-fire here, and a gas cooker or ring there; and no inquiry was made as to the capacity of the meter and what work had been added from time to time.

Mr. STONE (Birkenhead) was of the opinion that some of the cards were far too elaborate and too difficult for many of the workmen to follow, and in some cases had to be scrapped.

Mr. ROBINSON (Altrincham) gave very interesting information about the system they used at their works, and said that he was a very strong advocate of the card system for keeping records.

Mr. ALSOP (Bolton) advocated the following-up of the card system by loose-leaf ledgers, and remarked that where they had the system of costing it was most essential that the costs clerk should be in close touch with the manager, and report to him immediately he saw any increase in expenditure, or absence of anything that ought to be present; or they might as well scrap the whole system.

Mr. BUCKLEY (Manchester) gave the methods used in Manchester, and said he thought that the ordnance survey sheets, having the position of the syphons, mains, &c., marked thereon were all that were necessary, and were to be preferred to cards.

Mr. BATTERSBY (Bury) thought that the amount of water pumped from a syphon should also be recorded, as this was often very useful information.

Mr. HAYNES (Bolton) strongly condemned the practice of merely getting statistical information that was never used. He was very much in favour of costing all appliances, so that a customer could be informed exactly what the cost of any piece of apparatus would be.

The author having replied to the various questions raised,

Mr. PRINCE (Heywood) moved, and Mr. ROBINSON (Altrincham) seconded, a vote of thanks to Mr. Livesey for his paper.

COMPRESSED OIL-GAS HYDROCARBON.

By A. G. BURNELL and R. W. DAWE.

Every thousand cubic feet of oil gas which pass through the condensers and purifiers of an oil-gas plant into the holder deposit something like one gallon of hydrocarbon liquid in the tanks into which the oil gas is forced for storage purposes by the compressing engines at a pressure of 150 lbs. per sq. in., more or less. A small plant making 20,000 c.ft. of oil gas per day would produce something like 140 gallons of this crude hydrocarbon liquid every week—in other words, a volume equal to about one-fourteenth of the total amount of gas oil used in the plant.

At many works this substance is used as a fuel for steam raising, by firing it in a burner of the Holden type; but most gas engineers are fully alive to the fact that this is by no means an economical method of disposal for a liquid which has long been known to contain high percentages of benzole and its homologues. Unhappily, these valuable constituents are associated with a host of other compounds in the liquid, which render the hydrocarbon unsuitable for many purposes for which it could otherwise be very profitably applied.

Among the most lucrative uses to which it was hoped to apply it was as a substitute for petrol. Now a good motor spirit must, among other things, have a vapour tension somewhere in the neighbourhood of 70 to 80 at ordinary temperatures; it must evaporate in contact with air without leaving any deposit of a gummy nature; and it must not be too "fierce" in action. All three essentials are violated by the crude, evil smelling, and highly volatile liquid which is drawn from the compressed oil-gas storage tanks.

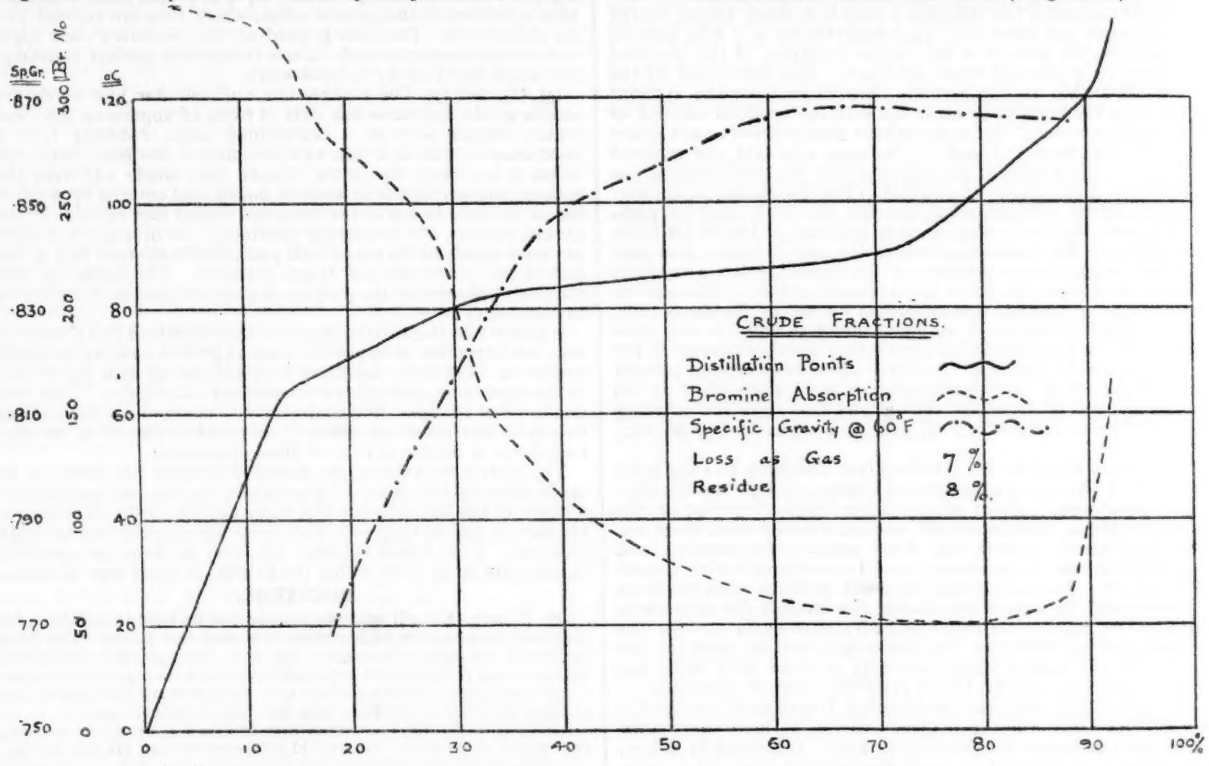
The high pressure at which the crude liquid is deposited causes the compounds so liquefied to be highly impregnated with gas, a considerable percentage of which remains in the liquid when restored to normal atmospheric pressure. Hydrocarbons, however, which were stable liquids under pressure are in an unstable physical state on reduction to atmospheric pressure; and these, together with the dissolved gases, are liberated so erratically that they render the crude liquid entirely unsuitable for use in petrol engines. This was, of course, anticipated; and it was thought that, by submitting the crude spirit to fractional distillation and discarding the lower boiling fractions (which were the cause of the "fierceness" of the spirit) and the high boiling fractions (which contained other impurities), the remaining portion of the distillate would be free from these objectionable properties.

This to a certain extent was the case. But it was soon found that the spirit so obtained left a tenacious, gummy deposit on evaporation in air; and this was disastrous to the efficient working of the carburetter. More careful fractionation was then tried; and the spirit so obtained was used by some engineers, either alone or mixed with petrol, and in some cases with petroleum, with the double object of reducing the high vapour tension and the percentage of gumming constituent left on evaporation. So mixed it has been used as a motor spirit; but in the authors' experience it left much to be desired. One of the chief sources of dissatisfaction was that, in order to reduce the gumming constituent in the mixture to a safe margin, only a very small percentage of the total available hydrocarbon was thus disposable.

Purification of the spirit by washing with strong sulphuric acid, by Nordhausen sulphuric acid, and by treatment with oxidizing agents such as chromic anhydride, potassium permanganate, &c., was also tried both on the crude spirit and on fractions thereof. By repeated washings on these lines, the authors and others succeeded in removing the gumming constituents entirely; but the processes were much too troublesome and expensive, and the yield too small to make their general application possible. The desirability of finding an easier and less expensive process was very pressing; and a determined effort to solve the problem was made in the private laboratory of one of the authors.

Below is a curve showing the distillation points of the sample of crude oil-gas hydrocarbon experimented on. The distillation was carried out with the aid of a twelve-bulb pear-head; the flask being heated in an oil bath. One thousand c.c. were distilled, and each fraction of 50 c.c. collected in separate receivers. The temperatures at which the spirit distilled were carefully noted.

The bromine absorption of the different fractions was then estimated by the titration of 10 c.c. with a bromine-yielding solution made by dissolving 49·584 grammes of potassium bromide and 13·916 grammes of potassium bromate in 1000 c.c. of distilled water. The results are shown in the curve (Diagram A.).



(Bromine numbers are C.C. of $\frac{N}{2}$ Bromine Solution absorbed by 10 C.C. of Distillate.)

DIAGRAM A.

Evaporation tests were carried out by exposing 25 c.c. of each fraction to a current of air at ordinary temperature in weighed vessels of such capacity that the liquid had a depth of ¼ in. The following residues were left:

	Grm.		Grm.
Fraction 1 . .	·080	Fraction 11 . .	·016
,, 2 . .	·072	,, 12 . .	·015
,, 3 . .	·065	,, 13 . .	·015
,, 4 . .	·052	,, 14 . .	·015
,, 5 . .	·038	,, 15 . .	·012
,, 6 . .	·027	,, 16 . .	·013
,, 7 . .	·020	,, 17 . .	·014
,, 8 . .	·020	,, 18 . .	·020
,, 9 . .	·018	(Cracking commenced.)	
,, 10 . .	·018		

The period of evaporation covered just over half-an-hour. The residues bore an approximately direct relationship to the bromine absorption; and this relationship was practically absolute when the evaporation was conducted at a sufficiently slow rate. These facts are important, since they demonstrate the utility of the bromine absorption test in ascertaining the maximum gum-depositing properties of spirit before and after treatment with different reagents.

Similar evaporation tests with twenty cubic centimetres were made in a current of producer gas freed from oxygen. The residues in these cases were practically negligible. In connection with the latter test, it may be remarked that the issuing producer gas thus enriched burnt with a highly luminous but smoky flame

from a burner of the batswing type; and when a bunsen was substituted the aerated gas gave an intensely hot flame.

It will be seen from the above that, though the various fractions were carefully separated, none was free from the objectionable gumming constituent when evaporated in air; and the reason for the failure of fractional distillation alone to produce a satisfactory motor spirit was at once evident. The bromine titration measures directly the proportion of unsaturated hydrocarbons present; and the latter were obviously responsible for the production of the gummy resinous substance on evaporation. Proof that oxidation is the cause of these deposits may be advanced from the fact that no such substances were formed when newly-fractionated spirit was evaporated in a non-oxidizing atmosphere, and that the amount of such substance in a given fraction increased proportionately to the bromine number of the fraction and to the time taken in evaporation—that is, in the time allowed for its complete oxidation in the air.

After a considerable amount of research, several methods were found whereby the bromine absorption was reduced to a very low number; but the most promising substances which would do this were found among the anhydrous metallic chlorides. Much work, however, was still necessary before the conditions most conducive to success were found. Prolonged treatment under reflux distillation was essential; and the reaction was much influenced by the temperature of the contents of the still. The best results were obtained by slowly raising the contents of the still to about 70° C., and progressively raising the temperature at regular intervals until at the end of from four to six hours the temperature had reached 85° C. The contents of the still were then fractionally distilled, and everything coming over below 140° C. collected and washed with soda solution and water, to remove traces of hydrochloric acid. Much depended upon the quality of the anhydrous aluminium chloride used; and it was not until this was obtained from wholesale makers of repute that uniform results were obtained, and the financial soundness of the treatment became apparent. Anhydrous aluminium chloride may now be obtained at a cost of about 1s. per lb.; and the treatment we found most satisfactory was carried out at a cost not exceeding 2½d. per finished gallon for reagents, including soda for washing, when the operation was carried out on the crude spirit as drawn from the storage tanks containing the compressed gas.

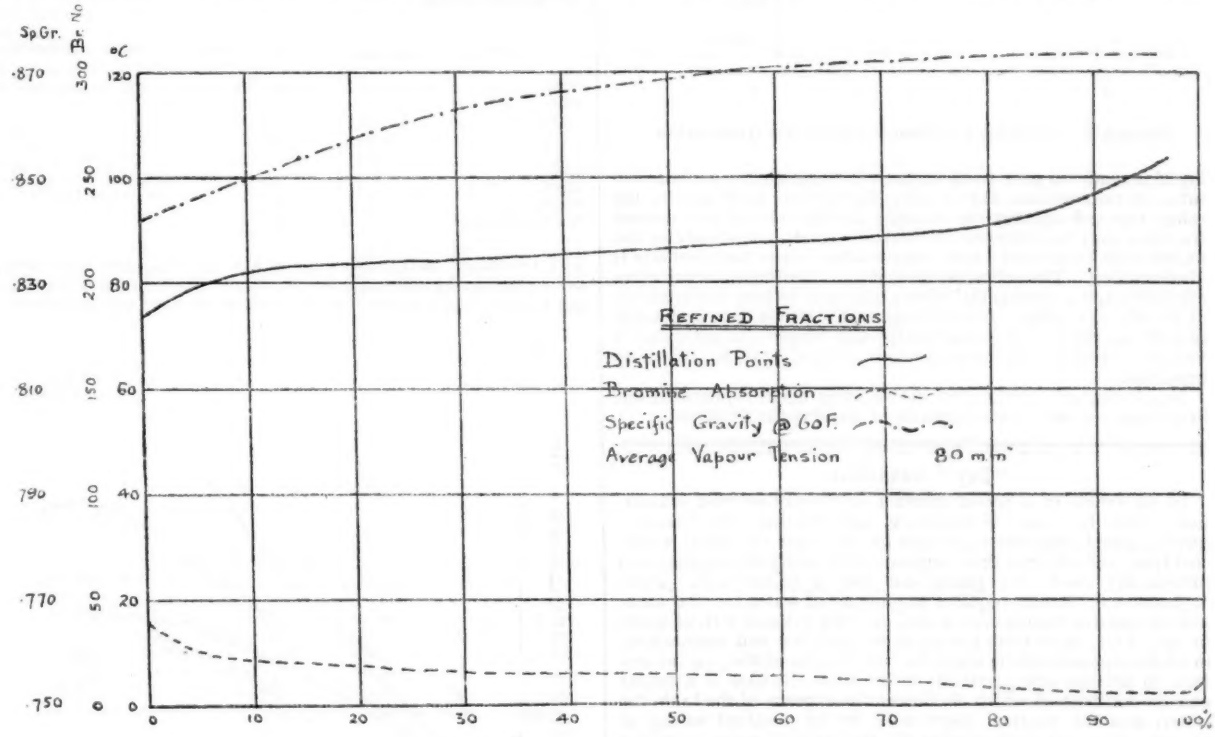
At one period considerable difficulties were experienced by the presence of organic chlorides in the product. An investigation proved that these were only present when the bromine number was above a certain figure, and that the lower boiling fractions were the cause of the trouble. It was traceable to too rapid a raising of the temperature during reflux treatment, which resulted in the light fractions being vaporized too quickly on return to the still from the condensing system, and their being thus deprived of proper treatment with the chloride. It was found that the trouble could be overcome either by more prolonged treatment, or by a short complete shutting-down of the plant for half-an-hour or so in the middle of the treatment, or by re-treatment of the distillate with a small quantity of the anhydrous chloride.

These organic chlorides were never present when the bromine absorption was below a certain figure, which varied slightly with different crude spirits. With the particular spirit used for the experiments, and the strength of bromine-yielding solution above specified, we failed to find such trouble when the amount of bromine solution absorbed did not exceed 25 c.c. for 10 c.c. of treated spirit. In none of the different spirits tried by us were such chlorides found when the number of cubic centimetres of bromine solution did not exceed 15.

In the worst cases, however, the organic chlorides were only present in small amount, and were really an indication that the gumming constituents were not yet all removed—that the metallic chloride was still doing its work. Such partially converted spirit invariably left a residue on slow evaporation in air; and when once 50 c.c. of a refined product from any particular source was found to leave no residue on evaporation, it failed to show the presence of organic chlorides, and the bromine absorption figure for that product was a safe standard for further treatment of the crude hydrocarbon obtained from the same source.

The loss as gas averages about 7 p.c.; and the yield of refined spirit varies with the nature of the crude hydrocarbon. This in turn is largely dependent upon the kind of oil used to make the gas, the temperatures of the retorts, and the compression of the gas. We have found the average yield from crude hydrocarbons from different sources to be about 70 p.c.

Diagram B. shows a curve of the distillation points, bromine absorption figures, and specific gravities of different fractions from the refined spirit yielded from the same sample as that used for the research. The refined spirit had a vapour tension of approximately 80 at 60° Fahr., left no trace of gummy residue on evaporation, and was not of unpleasant odour. An extended practical trial in a car was highly satisfactory. The sulphur content was 0·004 p.c., against 0·050 p.c. in the crude spirit.



(Bromine numbers are C.C. of $\frac{N}{2}$ Bromine Solution absorbed by 10 C.C. of Distillate.)

DIAGRAM B.

It is suggested that the gas liberated from the crude spirit be used for enriching coal or water gas, or producer gas, where these gases are made on the same premises, as frequently happens.

With regard to the tar-like matter left in the still after separation of the required fractions, it has been found that by blowing steam into it, a considerable quantity—in some cases over 50 p.c. of its volume—is distilled over. The spirit so obtained is highly unsaturated, but after soda-and-water washing may be used for steam raising or gas enrichment. The sludge remaining after this separation is discarded. This operation should be done in a separate still.

The authors have described (see patent No. 171,566) a plant suitable for the treatment of the compressed oil-gas liquid by this process; but any suitable plant may be used. Diagram C. represents a similar plant, which is heated by a steam-coil instead of a steam-jacket.

The plant is simple to make, and consists of a still carrying a continuous steam-coil capable of withstanding a pressure of 100 lbs. of steam per sq. in., more or less. A length of cast-iron gas-main, suitably flanged, makes a satisfactory still-head; and a lead pipe from this is connected to a water-cooled condenser carrying a lead worm. Some of the vapours here condense, and

pass into the lead-lined wooden separation box, whence the uncondensed gas escapes through the top tube, and may be utilized for any purpose required. The condensed liquid passes out of the separation box to the sighting box, which consists of a white-metal or lead lined cylinder with a plate-glass front and back, through which the rate of distillation can be seen. From this box, the

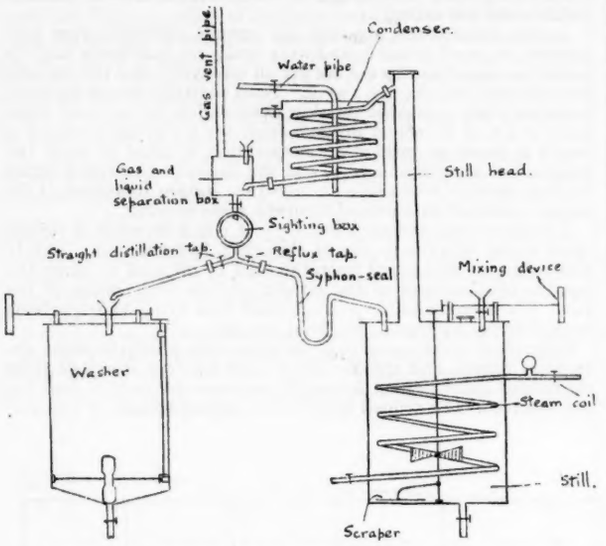


Diagram C.—Purification of Compressed Oil-Gas Hydrocarbon.

liquid is made to pass back to the still through the syphon-seal tube, for re-treatment during reflux distillation; or by closing the reflux tap and opening the straight distillation tap, any desired fractions may be collected in suitable vessels. A washer of the paddle type for the soda-and-water washing of the final distillate is also included. The action of the metallic chloride was much more efficient when a mechanical stirrer was used to keep the contents of the still in motion. In the absence of a stirrer, it is preferable to add the chloride in instalments—say, hourly—as otherwise it becomes coated with carbonaceous matter, and its efficiency impaired.

In a Patent of Addition, an accelerating agent is provided for, in conjunction with other methods of washing the distillate.

"Dry" Gasholders.

In an article in a recent number of "Das Gas- und Wasserfach," Herr L. Rodde, of Augsburg, asks whether "dry" holders have justified their existence side by side with the usual water-seal type, and whether their appearance is really in response to a present-day need. He points out that a 50,000 c.m. [about 1,750,000 c.ft.] holder requires 22,000 c.m. of water for the tank, and 28 c.m. for the cups, or a total of some 777,000 c.ft. of water in all. This, apart from having to be provided and maintained, must be kept sufficiently warm for five months of the year, at any rate, to prevent any possibility of freezing. So that, if a holder can be constructed which eliminates the expense of the tank, the water, and the heating, there must be an eventual saving of money. How out of proportion the quantity of water is to the gas pressure which necessitates it of 110 to 222 mm. [4·3 to 8·6 in.]! The article then refers to the various patents which have been taken out in Germany in this connection, beginning as far back as 1882. Reference is made to a description which appeared in the German journal towards the end of last year, of a 250,000 c.ft. "dry" holder at Durlach, which is giving every satisfaction.

Yorkshire Junior Gas Association.—By kind permission of Mr. Ralph Halkett, the General Manager of the Sheffield Gas Company, the members of the Association will on Saturday next visit the Grimesthorpe Gas-Works. From the Midland Station at 3.30, the members will be conveyed by special car to the Grimesthorpe Gas-Works, where there will be a reception and subsequently an inspection of the plant. Tea will be served in the recreation room.

Oil Reserves in the United States.—An investigation of the oil reserves of the country has convinced the United States Geological Survey that the available supply is only 9150 million barrels. This is said to be enough to satisfy the present requirements of the country for only twenty years, provided the oil can be taken out of the ground as fast as it is wanted. Of the total estimated oil reserves of the United States, 5000 million barrels are estimated as oil in sight, and 4000 million barrels as prospective and possible. Commenting on the production of petroleum in the United States in 1921, the Survey says that 469 million barrels were produced. This is the greatest quantity ever produced in the country in any one year, and represents an increase of 26½ million barrels over 1920, while it is more than double the quantity produced in the United States in 1912.

EXPANSION OF REFRACTORIES.

Abstract of a Communication to the Académie des Sciences.

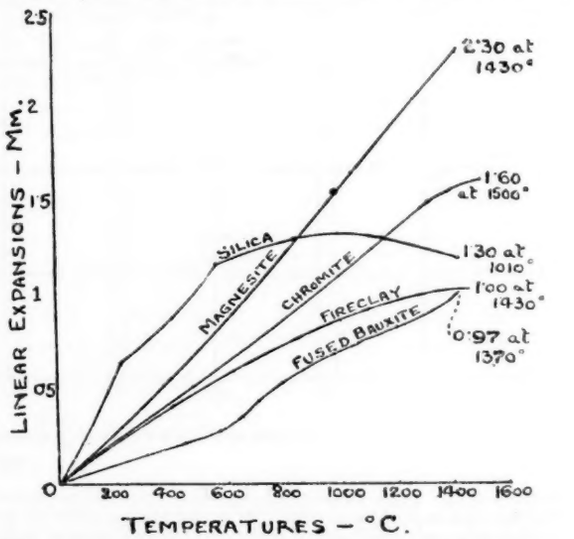
Knowledge of the behaviour of refractories under high temperatures is important to gas men, who should be able to choose, for instance, the right materials to include in the construction of both intermittent and continuous retorts—two cases in which conditions and essentials vary considerably. Research into the question has been carried out in France by Le Châtelier, Coupeau, Damour, and others; but in the majority of cases, experiments have not been continued beyond 800° or 1000° C. In view of the fact that retort temperatures usually are well above this figure, M. Bogitch (who prepared the paper for the *Académie*) devised a method which he put into use to determine the behavour of various refractory materials up to 1500° C.

A test-piece 9 to 10 cm. long and 3 to 4 sq. cm. in cross section is cut from a brick of the material under trial, and is placed on end in a small laboratory furnace with the necessary temperature range. Alongside the test-piece is put a block of fused silica a little longer than the test-piece, and showing above the furnace; while on the top of the test-piece is fitted a small lump of the silica, which brings the two projecting faces exactly level. Thus the test-piece may be uniformly heated, and microscopic observations and measurements made on the portions projecting from the furnace.

The following table shows the percentage compositions of the refractories tested:

—	Fused Bauxite.	Fireclay.	Chromite.	Silica.	Magnesite.
SiO_2	32·25	62·49	5·15	94·71	7·50
FeO	..	..	9·44	..	..
Fe_2O_3	0·50	0·46	..	3·24	2·30
Al_2O_3	64·53	21·50	9·20		
Cr_2O_3	..	..	50·23	..	..
CaO	..	..	..	1·60	3·12
MgO	..	..	..	..	88·32
Na_2O	..	3·75	..	..	..
Not determined	1·62	1·80	25·98	0·45	..

The results of tests made on the five materials specified above are reproduced graphically below, degrees Centigrade being plotted against linear expansions in millimetres of 10 cm. test-pieces.



It will be seen that the least variation occurs in the fused bauxite brick, a material rich in alumina and poor in silica; this being therefore suitable for sudden changes of temperature—such as are met in heavy-oil stills, where a rise of 1600° C. is often effected in an hour or two. The silica curve is most irregular, the slight contraction above 1000° C. being clearly traced-out. Two points in the curve are noteworthy—about 210° and 570° C. They mark the conversion of the cristobalite and of the quartz. According to the author's experience, ovens lined with silica should be put gently to work with a temperature rise not exceeding 50° C. an hour. In general, refractories high in alumina are suitable for intermittent work; while a large magnesia or chromite content demands the easier life of continuous and regular heating.

Mr. Richard Thomas Glover, of Dartmouth Park Road, N.W., late Chairman of Messrs. Glover and Main, Ltd., Gothic Works, Edmonton, who died last September, left £16,554.

The Association of Engineers-in-Charge are holding an informal discussion on Saturday evening next, March 18, at St. Bride's Institute, Bride Lane, E.C., at 7.30, to debate the merits of Diesel and other oil-engines for industrial work. Visitors are invited to be present and take part in the discussion.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Terms, Sperms or Therms.

SIR,—It is to be hoped your readers will not take Mr. Bradfield's figures in his tables to go further than he could intend. They are calculated not on therms ascertained, but declared. The war's reactions and the coal strike direct action prevented the declarations being generally adhered to. Fortunately, those who could make gas from coke did so, to the saving of coal!

As I have already made clear to Mr. Bradfield himself, the tables are valueless for comparisons in this particular year, as most of us up to the spring were not put upon the therm basis. The accountant can only do his best and work on the professed and legal base. Like the candle sperms, they could not be adhered to in wars and strikes. No clear comparison is possible.

H. E. JONES.

Westminster, March 12, 1922.

The Neutralization of Sulphate of Ammonia.

SIR,—The paper by Mr. T. Johnson, B.Sc., on this subject, which appears in this week's "JOURNAL," is of interest to me for two reasons. First, as a faithful record of failure and success in the endeavour to solve a technical problem; and, secondly, because the method which was ultimately adopted—that, namely, of mixing soda ash with the acid salt—is one to which I was at one time attracted. Some years ago I applied for a patent, and was granted provisional protection, for this very process; but as the result of further experiment, I decided it was not worth going on with, and so never filed the complete specification.

To all methods of neutralization by the addition of alkalis there is, in my opinion, a strong objection. This is that the acidity of the salt, as discharged from the saturator, is bound to vary from time to time; and it is practically impossible to add sufficient alkali for neutralization without overdoing it and making the salt alkaline. Now, an alkaline sulphate is necessariiy a discoloured sulphate; and it was the realization of this truth which led me to discontinue my experiment with soda ash. The sulphate produced under my own patented process—in which the magma of salt and acid discharged from a weak, but still acid bath, in a specially arranged saturator, is enveloped in a spray of pure water before drying—is, on the contrary, pure white, and without impurity.

If, however, the desirability of neutralization by admixture be admitted, then it seems to me that England's patent, No. 10,781, of 1908, shows what is best to use. This is a phosphate of lime, or bone meal, which contains a little ammonia in comparatively loose combination, and which adds to the sulphate nothing but what is, of itself, a valuable fertilizer. England's process was employed intermittently at Sheffield, in 1909, for a special purpose; but there was not, at that time, any great interest in neutral sulphate, and the application was not continued.

JOHN T. SHEARD.

Sheffield, March 10, 1922.

The Therm and Gas-Works Practice.

SIR,—It was not my intention to trespass further on your space with this discussion, but "Engineer" will reasonably expect a reply to his communication to the "JOURNAL" for Feb. 22.

The figures given in my original communication were hypothetical revenue figures only, with a view to comparing the difference in the return on the capital invested in each case. The cost of the therm was of no importance in this statement, because, even if it cost the same for each process, there was still a great difference in the profits which would permit a reduction in price. Subsequently, I stated that the cost of production was approximately in proportion to the coal handled, and that if the output of therms were doubled the cost per therm was halved. Excepting these two statements, "Engineer" I think agrees with my reasoning.

First, the net coal cost of the therm. Residuals are only therms in one particular form; they are not something for nothing, and they are a credit item only so long as they realize more than they cost. The residuals may actually increase the cost of the therm in the gas; and I should like to demonstrate this from actual working results. Referring to the first column results published in p. 445 of the above issue, the net coal cost of the therm is given as 4·46d. Had the coal been completely gasified, the cost would have been 2·55d.; and the difference is due to the works having sold a portion of their therms below coal cost price. They bought a ton of coal (containing 310 therms) for 45s., or 1·74d. per therm. Of these 310 therms, 63·5 went into the gas, and the remaining 246·5 went into residuals, or the four winds of heaven. But wherever they went they produced a revenue of $58\ 75 \times 4{\cdot}16 = 244$d., or less than 1d. per therm, which meant a loss of 0·74d. per therm on 246·5 therms, and added 2·86d. to the coal cost of the therm in the gas, making it 1·74d. *plus* 2·86d. We are not concerned here with labour and other charges; but if the comparison is continued to these also, it will be found that the difference is further increased until the total production cost in the first case is not far short of three times the second, bearing in mind that only 6 cwt. of coal are required, and there are no residuals to handle in the latter process.

Secondly, thermal efficiency. I have not worked-out the proportions of the money lost by the works on the 246·5 therms due to residuals and thermal losses respectively. Doubtless their thermal efficiency is as high as possible within the limitations of their process; but it is a great pity, after striving hard for higher efficiency, they should find that, having obtained it, the results have been negatived by a fall in the residuals market. Any similar increase in efficiency in complete gasification is solid gain.

This question of thermal efficiency is very important, because the present practice is almost at the limit in this direction; while complete gasification is only in the crude stage. Suppose the works in question had approached one of the "five-legged rabbit" conjurers and obtained one of their magical plants giving 100 p.ct. efficiency, the net coal cost of the therm would have been only 1·74d. This may be unattainable; but it does not follow that the efficiency allowed for the gasification process is going to remain at the 70 p.ct. which is already obtained. It will be substantially increased as the plants are improved, and with every increase there will be a fall in the cost of the therm.

I have already admitted that there are special cases where the residuals are a very remunerative item—*i.e.*, where the works are operating under practically coke-oven conditions—but from a perusal of the published analyses it would appear that the majority of works are not in this happy position, and conditions in this respect will not be improved by the increasing competition of bye-products from various other sources.

A. MACGREGOR.

43, *Whitelow Road, Chorlton-cum-Hardy, Manchester.*
March 6, 1922.

"The Five-Legged Rabbit."

SIR,—Professional duties away from town prevented me from enjoying your issue of March 1, fresh from the press; and I was unfortunately too late to read, in time for reply, the correspondence which now passes under the prominent title of the "Five-Legged Rabbit."

Progress would be very sadly handicapped should there be no friendly rivalry among professional and scientific men; and in order to help progress, they cross swords in a friendly bout, choosing the columns of an official organ of their profession as the field of combat. Happily the great majority of these men will fight with the proper weapon, and know how to take victory or defeat with dignity.

I consider the pages of the "GAS JOURNAL" too valuable to fill up with indiscretion or personal affairs. Still, to enlighten Mr. C. B. Tully, I may say that I have been engaged in the chemical, thermo-chemical, and metallurgical "profession" for the last twenty years; and at the present time I am building gas plants of my own that are based, not on inspiration, or that are shrouded in mystery, but are being built on the solid rules and "possibilities" of science and thermo-chemical theory, combined with the "common or garden" rules of practical engineering, and of which he would like to know. So I believe I have full right to claim to be one of the "profession."

There is very little need to possess second sight or to have imagination armed with ultra-violet rays of penetration to understand what he claims a "secret;" and, again, it requires more than a mere statement to prove an efficiency of 125 p.ct. from any apparatus.

I raise my hat and bow to the profession, bow to all your contributors and correspondents who so impartially and openly discuss matters and problems of science. I bow to you and your paper to act as a link of intercourse between men of a profession; and I will bow to the man who will come forward with a scientific beehive, and be able to send out his scientific bees to gather all the atmospheric B.Th.U., to be stored and distributed to the community.

E. F. MURRAY.

25, *Burton Road, Brixton, March* 11, 1922.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 8.]

Nos. 5674 to 6490.

AKTIEBOLAGET LJUNGSTRÖMS ANGTURBIN.—"Regenerative air and gas preheaters." No. 5918.

BLACK, H. D.—"Pipe-joints." No. 5874.

BLAKELEY, W.—"Gas-condensers." No. 5725.

BLINDED SOLDIERS' AND SAILORS' AFTER-CARE ORGANIZATION.—"Coin-controlled device for delivering illuminating gas." No. 5952.

BRITISH DYESTUFFS CORPORATION, LTD.—"Separating alkylamines from ammonia, &c., gases." No. 6488.

CLAY, J. B.—"Flow-meter, &c., for gases." No. 5848.

COPPI, L.—"Pipe-joints." No. 5914.

DELLWIK, C.—"Separation of liquid from other matter." No. 6473.

FRASER, I.—See Blinded Soldiers. No. 5952.

GALLON, J. D.—"Gas-heated radiators." No. 6352.

GREEN, A. G.—See British Dyestuffs. No. 6488.

HELPS, G.—"Gas burners and cookers." Nos. 5684, 6402.

HODGSON, J. L.—"Nozzles and orifices." No. 6268.

JOHNSON, V. L.—See Gallon, J. D. No. 6352.

LAWRENCE, J.—"Means for discharging vertical gas-retorts and coke-ovens." No. 5825.

LILLEY, J. H.—"Gas-cooker." No. 6035.

MORGAN, J. S.—"Separating oxygen from atmospheric air." No. 6080.

MORGAN, J. S.—"Method of separating mixed gases." No. 6081.

OXLEY, H. P.—See British Dyes. No. 6488.

ROSE, C. E.—"Portable atmospheric gas-stove." No. 6012.

SHAW & CO., LTD., A.—See Rose, C. E. No. 6012.

TIDDEMAN, E. S.—"Apparatus for preventing escape of gas from gas-burners, &c." No. 5890.

WESTWOOD, W. W. SKIDMORE.—"Apparatus for the manufacture of coal gas." No. 5861.

WOODALL, DUCKHAM, AND JONES (1920), LTD.—See Morgan, J. S. Nos. 6080, 6081.

YOUNG, W. H.—See Lawrence, J. No. 5825.

A Further Reduction at Bristol.—The Directors of the Bristol Gas Company have decided to further reduce the price of gas 3d. per 1000 c.ft., to date from the reading of the meters at the end of the current quarter. The revised price to be charged on the June quarter's accounts will be 3s. 11d. and 3s. 8d. per 1000 c.ft. to power users and consumers of 500,000 c.ft. per annum and upwards. This is the second reduction made by the Company during the present year, making a total reduction of 7d. per 1000 c.ft.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Kilmarnock Gas Provisional Order Bill: Read the third time, and passed.

The following Lords Select Committee has been appointed, and is to meet on the 21st inst., to consider the Ramsgate Corporation Bill and the Stretford and District Gas Board Bill: Earl Stamford, Earl Chichester, Viscount Hood, Lord Kintore (Chairman), Lord Redesdale.

The Select Committee appointed to consider the Bolton Corporation Bill and the Doncaster Corporation Bill will consist of the Marquis of Bath (Chairman), the Marquis of Linlithgow, Viscount Falmouth, and Lord St. John of Bletso; to meet on the 21st. inst.

A petition has been deposited on behalf of the Dundee Gas Commissioners against the Grampian Electricity Supply (substituted) Bill.

HOUSE OF COMMONS.

A resolution was reported from the Select Committee on Standing Orders that in the case of the Chester Gas [Lords] Petition for Bill, the Standing Orders ought to be dispensed with, and that the Company be permitted to proceed with their Bill. The resolution was agreed to.

Gas Regulation Act, 1920.

A copy was presented of Rules—entitled the Gas (Special Orders) Rules, 1922—made by the Board of Trade with respect to applications for Special Orders under section 10 of the Act.

Public Utility Companies (Capital Issues) Act, 1920.

A copy was presented of a report on an application by the Ashton Gas Company to the Board of Trade under the Act.

Imported Gas-Mantles and Taxation.

Mr. Kiley asked the President of the Board of Trade whether he was aware that Mr. Cyril Atkinson, K.C., announced his decision, under Part I. of the Safeguarding of Industries Act, that a duty of 33⅓ p.ct. should be imposed upon certain materials which were constituent parts of gas-mantles; whether, under the Act, a decision so given was final; whether, some time later, this Referee, without any public announcement, agreed to state a case for the High Court; whether he could say at whose instance and by whose authority a case had been stated after the decision was given; why no intimation of these proceedings appeared in the Press; whether he could state when the case would come before the courts; and whether the Board of Trade would be represented by Counsel.

Mr. Baldwin said he was aware that the Referee announced what his finding would be in the particular case mentioned, but he deferred signing an award in order to give any one of the interested parties an opportunity to apply to him to state a case for the High Court, and subsequently made an explanatory statement to remove doubts. An application for statement of a case was made by the manufacturers of gas-mantles, who were the original complainants. The procedure was discussed on two occasions before all the parties, and in the presence of representatives of the Press. The decision of the Referee to state a case was communicated to all the parties, and no further announcement appeared necessary. He was aware that the Safeguarding of Industries Act laid down that the decision of the Referee should be final and conclusive; but as the precise bearing of that provision on the finding of the Referee in this particular case was one of the questions to be determined by the High Court, it would be improper for him to express an opinion on the subject. With regard to the last two parts of the question, he had no information.

Maximum Price Raised at Aberavon.—The gas undertaking of the Aberavon Corporation having been adversely affected by circumstances arising out of the war, the Board of Trade have issued an Order permitting an increase of charges to a maximum of 7s. per 1000 c.ft. It is stipulated that no part of the balance of the undertaking's revenue is to go to the relief of the rates when the price charged during any part of the year exceeds 5s. 6d. per 1000 c.ft.

Chesterfield Gas Prices.—A discussion arose at the meeting of the Chesterfield Town Council last week, on a recommendation of the Gas Committee that application be made to the Board of Trade for authority to fix the maximum charge for gas at 1s. 4d. per therm inside the Borough, and 1s. 6d. per therm outside. Alderman Cooper remarked that this arrangement would be quite a charter for consumers; for a certain standard of quality would have to be maintained. The Committee also recommended a reduction of 6d. per 1000 c.ft. on April 1; and he explained that the borough price would then be 4s. per 1000 c.ft., while the Committee hoped to make a further reduction as soon as conditions allowed. The recommendations were agreed to.

Oswestry Town Council and Gas Prices.—The Oswestry Town Council, on Monday last week, received a letter from the Gas Company, in reply to a request from the Council for an explanation of the high price of gas. The Company pointed out that the gas in Oswestry was cheaper than at some neighbouring towns, and that nothing but coal gas was made, of an average quality of 16 candles—a quality that few gas companies were now making. The price was in 1914 3s. 6½d. per 1000 c.ft., and 2s. 10d. to large consumers; and the rate at the present time was 6s. 8d., and to large consumers 5s. 8d. During the coal strike, the Company lost nearly £3000. The Council passed a resolution that, having heard the reply of the Gas Company, they were of opinion that the price of gas was unnecessarily high, having regard to all the circumstances. It was admitted that the Company served the town admirably throughout the strike.

MISCELLANEOUS NEWS.

BRITISH COMMERCIAL GAS ASSOCIATION.

SOUTHERN DISTRICT CONFERENCE AT SOUTHAMPTON.

The first of a new series of conferences of the British Commercial Gas Association—that for the Southern District—took place on Tuesday of last week in the Coliseum, Portland Terrace, Southampton, when between fifty and sixty representatives of gas companies and local authorities assembled. The morning session was devoted to a reception of the delegates by Dr. Russell Bencraft, J.P. (Deputy-Chairman of the Southampton Gas Light and Coke Company), and an inspection of the newly-organized distribution stores of the Company.

DISTRIBUTION STORES OF THE SOUTHAMPTON GAS COMPANY.

Dr. Bencraft's welcome was very brief, but cordial; and the party were then conducted over the department by Mr. J. R. H. Jacobs (General Manager and Secretary of the Company), who explained that the system was that recommended by the British Commercial Gas Association under their Commercial Organization. It was simple to work, required a minimum of staff, and ensured accuracy in costing. This was the first section of a complete system embracing distribution costs and stores; repair shops; works costs and stores; census; and rental. In adopting the system, he was dealing with it in sections, getting one in thorough working order, and seeing that everyone was thoroughly in touch with his job before commencing another section. The section they were visiting was the distribution department, which was commenced nearly six months ago, when the new distribution stores were opened. The scheme was first thoroughly explained to the clerical staff, inspectors, and fitters. Sufficient material was transferred from the old stores prior to commencement, and, after closing on Saturday morning, all other materials, books, &c., were transferred in the afternoon, and the new system started from the new stores the following Monday! Minor difficulties arose during the week; but the next week everything was working smoothly. The clerical staff as now arranged had the full responsibility of arranging for the issue of materials, the issue of job vouchers to the district inspectors, overseeing as to delays, preparation of wages, and recording of materials and costing. By this means inspectors, fitters, and storekeepers were relieved of clerical work and could give full attention to their own special duties. The costing under the system was simple but effective, and all costs were gathered together into the cost book, which provided all the information required by the accountant's department.

Under the system, job vouchers in duplicate were used for every order, inquiry, or complaint, and each department—rental, showroom and collector—was provided with a set. The name, address, and particulars are filled in and sent to the distribution office. Work could be divided up into three classes: Straightforward jobs, complaints, &c.; jobs requiring materials and delivery; jobs necessitating an inspector's call, inquiries, estimates, &c. After receipt in the office the vouchers under No. 1 were districted to the inspectors for issue to fitters. Vouchers requiring the issue of material were passed to the stores for materials to be prepared for delivery by van or to the fitter. The material issued was entered on the stores summary of issues and returns. This summary gave the total issues and returns each day, the totals being posted daily to the stock cards. The voucher was then returned to the office, and, if correct, was then ready for issue to the inspector for allocation to the fitter. Each fitter was allocated sufficient vouchers for a day's work, the numbers of each voucher were entered on a summary form, and the job voucher and summary placed in a case for the fitter. The fitter proceeded at once to the stores and drew materials for his jobs, heavy material having already been delivered in advance. With 32 fitters they were able to supply every man and send them out within 20 minutes of clocking-on. The duplicate voucher was filed in the office awaiting the return of the original. The outstanding file was overlooked periodically, surplus material was returned to store, and credited on the job voucher and stores summary. When work was completed, vouchers and summaries were initialled by inspectors, and returned to the office and attached to the duplicate. From the fitters' daily summary labour was priced, as also were materials, and totalled on each original voucher. These particulars were posted to a cost book in such a way that from day to day the total costs could be readily obtained, if necessary, by the accountant. Where work was unfinished, the time occupied by the fitter was entered from his summary to the duplicate, and transferred to the original, when it was finally returned to the office. Accounts for work done were made out and sent in immediately, if necessary, or passed to the rental department for rendering at the end of the month. Details of meters, cookers, fires, &c., fitted or removed are passed on to the rental department. The motor drivers were supplied with daily sheets showing deliveries and collections. There was a stock card for each distinct class of material in the stores; issues and returns were posted daily. Each card showed maximum and minimum stocks, and the stock clerk could see at a glance how the stock stood, and know when to advise the chief clerk regarding ordering. Instead of stocktaking at fixed periods, there was a continuous stocktaking. At the close of the half year or year, it was only necessary to take details from stock cards.

The mantle maintenance department was being worked on similar lines. Duplicate boxes were kept, one for each fitter, the boxes being used on alternate days. No time was wasted. Each fitter was provided with record card and daily summary; the average time occupied per burner, number of burners attended to, and materials used being recorded each day and priced. The average number of jobs dealt with per week was about 1700, exclusive of burner maintenance. The clerical work was carried out by one chief clerk, eight clerks, one transport clerk, and one office lad. The practical staff consisted of six inspectors, 32 fitters, and 10 fitters' mates. The burner maintenance

staff was composed of 16 fitters, nine men, eight women, and five storekeepers and assistants.

The advantages were a minimum staff, who all had their own special work, but could, if need arose, be switched-over to assist others; there was combination of effort and team work; the position of any job could be readily ascertained; there was economy of time and labour; a minimum amount of stationery required; and stock under control could be checked at any time.

THE LUNCHEON.

The Mayor of Southampton (Councillor F. Bath) and the Deputy-Mayor (Alderman H. Blatch, J.P.) were among the guests at luncheon, given by the Southampton Gas Company. Mr. J. C. MOBERLY, M.A. (Chairman of the Company), presided.

In proposing the toast of "The British Commercial Gas Association," his Worship said that he appreciated the difficulties the gas industry had experienced through the war period. "It cannot be said that you have benefited as a result of the war," he observed, amid laughter. The Southampton Company had been severely penalized; but he hoped the result of that day's deliberations would bring a prosperity equal to that of pre-war.

Mr. F. W. GOODENOUGH (Chairman of the Executive Committee of the Association) replied, and expressed the thanks of the organization to the Mayor and to the Southampton Company for the cordial welcome and generous hospitality accorded them. Particularly did he thank Mr. J. R. H. Jacobs for his assistance to the Association for many years. On the General Committee they had always found him a most interesting and helpful colleague.

The toast of the "Southampton Gas Company" was submitted by Mr. H. C. HEAD (Engineer and General Manager of the Winchester Gas and Water Company); and, in reply, Mr. MOBERLY said he really believed the gas industry was now on the top of the wave. They had had their troubles; but they had got over them, and might look forward to times of real prosperity.

Dr. RUSSELL BENCRAFT, at a second luncheon party, proposed the toast of "The Visitors," to which Mr. W. E. PRICE (Engineer of the Hampton Court Gas Company) responded.

A tribute to Dr. Bencraft's valuable work at the Glasgow Conference was paid by Mr. W. M. MASON (Manager of the "B.C.G.A.").

THE AFTERNOON SESSION.

Mr. J. C. MOBERLY (the President of the conference) addressed the meeting at the opening of the afternoon session, which was largely attended, many of the general public being present. Dealing with the aims of the Association, he said that the Association was started about ten years ago. Its objective fell under three heads—first, to make gas better known to the public; secondly, to offer expert advice and assistance to gas undertakings in any local difficulties; and, thirdly, to remove prejudice. That prejudice did exist, there was no doubt. There was prejudice, and a great deal of ignorance about the making, and especially the using, of gas. Some readers of newspapers might have been startled by leading articles and correspondence on the dangers of gas. They had not had a single genuine fatal accident in their district (Southampton), where they had tens of thousands of consumers, in the past year. Touching on the progress of the Southampton Company, the President said the volume of gas consumed in their district was 1200 million cubic feet in 1921, against 277 millions thirty years ago. The gradual organization of labour, which had presented certain difficulties, they had found from experience, so far from troubling the Company, had enabled them to establish first-rate relations with their employees. They had had hard times lately; and the new legislation had put them in temporary difficulties, one being that of finding fresh capital, which was badly needed to enable them to carry out what they were trying to do for the benefit of the public. The coal strike had hit them hard; and they reckoned it had cost them at least £10,000. Through this, they were obliged to postpone any reduction in charges. This, however, they had since been enabled to effect, and hoped a further reduction would be possible. With harmonious working of employer and employee, and a reduction of taxation, they could look forward to a still greater future for the gas industry.

Mr. GOODENOUGH, on behalf of the Association, thanked the President for his address, which had illustrated the Association's aim to give good service to the industry, and so to the nation. In reference to propaganda of opposed interests and the Press "stunts" on the danger of using gas, he said there was no ground for alarm. The fact was that there was no increase in the danger of using gas to-day, which was attended only with the same or less danger as was the use of other facilities of civilized life. The Association persistently and insistently advocated good service to the consumer; and there had been a marked response to their policy of regarding satisfaction of the consumer as the foundation of all true prosperity, and the surest guarantee of that prosperity and future development.

THE SMOKE NUISANCE AND THE HYGIENE OF GAS.

Mr. J. R. H. JACOBS (General Manager and Secretary of the Southampton Gas Company) then read a paper on "The Smoke Nuisance and the Hygiene of Gas." In doing so, he said he did not attempt to claim originality, but rather wished to place before them in concrete form an epitome of the considered opinions of leading scientists and other well-qualified professional men who had devoted years of study to these most important subjects. On the subject of the smoke nuisance he dealt at some length with the interim report of the Ministry of Health Departmental Committee on Smoke and Noxious Vapours Abatement, which he declared should be read by all interested in the broad question of health. The recommendations of the Committee, he remarked, bore eloquent testimony to the hygienic value of gas as the most effective and economical substitute for raw coal, and had been taken up with enthusiasm in certain localities—particularly in the North of England—where the smoke nuisance was positively a danger to health. At Liverpool, where thousands of houses were being erected, only one coal-fire was permitted—that was, in the living-room. As a result, a direct economy was effected in the cost of building, because the large coal-fire flues and the cumbersome chimney-breasts, which protrude into the room, were abolished. The small flues required for gas-fires could be built into, and form part of, the main walls. It was for the public to decide whether there was to be a continuation of the smoke nuisance, with its accompaniment of darkness, dirt, and disease, or its alternative smokeless fuel, with a perpetually clear atmosphere, economy in building, and saving of domestic labour, also a low death-rate. Surely it was worth while making some small sacrifice of tradition to attain such benefits; but these could not be obtained except by inducing the Government to bring-in suitable legislation to this end, and the most efficient spur was an insistent demand from the general public.

The modern gas-fire (properly fixed and properly maintained), he said, was not injurious to health; but, on the other hand, it was a decided factor in improving the conditions of life, which made for health by materially reducing labour in the home and increasing comfort and convenience—especially in times of sickness—by improving the ventilation of the room in which it was fitted, and by materially assisting in solving the smoke problem, which was a dangerous menace to the public health. In questions relative to the health of the community, they naturally looked to the doctor as the expert whose advice and guidance were essential. The views of the medical profession respecting the use of gas-fires might be well explained in the following illustration: In 1914-15 (the war since then had made it impossible to get further data) one of the largest gas undertakings obtained statistics of the proportion of doctors in its area of supply using gas-fires. The total number of doctors under review was over 4000, and included the most important medical consulting district in the world. Of these upwards of 3300, or over 82 p.ct., were known to be using gas-fires. The total number of fires known to be in use was 8455, an average of nearly three fires per house. Some of the largest hospitals used gas-fires exclusively for heating; and in others gas heating took a very prominent part. In the general heating of the building, one hospital alone had over 300 stoves in use. Taking a local example, the large Red Cross and Welsh Military Hospitals erected at Netley during the war (where thousands of wounded soldiers were nursed back to health) were almost entirely heated by gas. A prominent doctor had stated that the use of properly-fitted gas-fires in bedrooms had cost him a fortune in diminished fees. He further stated there was no greater danger to people susceptible of bronchitis and other ailments of the respiratory organs than to leave a warm sitting-room, go to a cold bedroom, and there undress and get into bed. A gas-fire in the bedroom, lighted for an hour before retiring, removed this danger.

It was estimated that the increased use of gas-fires in London—now upwards of 2,000,000—had greatly assisted in reducing London fogs. Forty years ago the average of foggy days was thirty per annum. Taking the past few years, it had not reached double figures, and even then the fog was not of that "pea-soup" consistency well remembered by all who had the misfortune to reside or do business in London during the winters of thirty to forty years ago.

GAS IN RELATION TO MODERN HOUSING AND FACTORY REQUIREMENTS.

Mr. W. J. SANDEMAN (Croydon) contributed a paper on "Gas in Relation to Modern Housing and Factory Requirements," which he opened by briefly sketching the history and development of gas. He then explained clearly the change-over to the therm basis of charge. He said that, with gas at 1s. 1d. per therm, and electricity at 8d. per unit (the prices obtaining to-day in Southampton), candle power for candle power, gas was three times cheaper, besides being less expensive in the matter of maintenance. He then dealt with the use of gas for other purposes than lighting. Of late, he said, one had heard of electrical developments in the matter of cooking and heating; but the whole fields of domestic and industrial heating were, legitimately, gas's own on the question of cost—if for no other reason. For cooking operations, practical tests had shown that 1 therm utilized in gas cooking would perform the same work as 20 units of electricity consumed in electrical cooking. In Southampton, a therm to-day costs 1s. 1d.; whereas 20 units of electricity at 2d. per unit cost 3s. 4d. This disparity might be larger, or smaller, in proportion to the amount of cooking or boiling operations performed. Electrical enthusiasts themselves admitted that electricity was an extravagant and costly method of water heating. With gas at 1s. 1d. per therm, a geyser would provide a 20-gallon bath in ten to fifteen minutes at an approximate cost of 2d. It was of the utmost importance that gas-fires, geysers, &c., be fitted in a workmanlike manner, and supplied by pipes of adequate size. It was even more essential that proper provision be made for discharging the products of combustion into the open air. Much publicity had recently been given to "odourless" gas-heaters "requiring no flue," and he did most earnestly appeal to consumers, in their own interests, to leave such appliances severely alone, as no gas-heater in an ordinary dwelling-house should be supplied with a flexible connection and placed in any position in a room. It should be fixed rigid, with the flue-outlet directly connected to a chimney. After pointing out the many advantages of the "all-gas" kitchen, Mr. Sandeman went on to say that actual tests had shown that gas-coppers were, if anything, cheaper to use than the ordinary solid-fuel built-in coppers. Two similar weeks' washing for two adults and three children cost: (*a*) With gas-copper, 4d.; and (*b*) with coal-fired copper, 5d.—with gas at 1s. per therm and coal at 55s. per ton. Hospitals, hotels, restaurants, canteens, &c., and all large institutions, used gas almost exclusively for cooking purposes; while hotels that had no gas-fires in their bedrooms stood very little chance of securing patronage. The section of the paper dealing with industrial uses of gas is reproduced.

Having made inadequate reference to the domestic uses of gas, we must now turn our attention for a few minutes to the other immense field which is open for the activities of the gas industry—viz., the application of gas to manufacturing processes. It will be difficult to-day to find a factory or workshop in which gas is not employed in some form or another; and yet we have only touched the fringe of our industrial load.

Although gas was used for industrial purposes previous to 1914, war conditions gave it such an impetus as it could never have hoped to

receive under normal conditions. As a result, remarkable progress was made in a surprisingly short time. One authority tells us that in this direction more progress was made in five years than in the previous fifty. Gas for manufacturing processes may be said to have come into its own during the last seven years. To-day, the urgent call is for increased production—more output. Indispensable as gas was during the period of strife, it is even more necessary during the present trying times, when the manufacturing world is endeavouring to get an economic balance and stimulate demand for its goods. Anything that will help forward and cheapen production must be fostered in the nation's interests in every conceivable way. Gas as an industrial fuel proved its worth during a vitally critical period in the nation's history, and consequently, having stood such a severe test, and emerged with flying colours, it may rightly be regarded with confidence by manufacturers who to-day realize its efficiency and almost universal scope of application. It has been estimated that something like 2000 distinct industrial heating processes can be accomplished by gas; and while lack of time renders it impossible (interesting as the subject is) to dwell upon the technical uses of gas, it is felt that a few of its applications may with advantage be briefly referred to. All works require power, and the gas-engine has established itself as a most efficient, reliable, and economical prime mover. Where it is desired to distribute electrical power to various units scattered about a wide works, the current can be cheaply generated by a gas-engine and dynamo. This represents a sound financial proposition, as it is possible in this way to utilize electricity at a far more favourable figure than if it be taken from local supply undertakings. Should steam power be required, the requisite steam can be quickly raised by means of a gas-fired boiler.

Then there is that wide field of the heat-treatment of metals, in which processes gas-furnaces are an unqualified success, because of the ready manner in which temperatures can be controlled. Among these heat-treatment processes, one may mention tempering, hardening, annealing, case-hardening, &c. We also have metal melting by means of the gas-fired crucible furnace. With natural-draught burners, temperatures of about 1000° C. can be maintained on the floor of a "muffle" furnace. For temperatures over this figure, it is desirable—in order to ensure economical working—that the burners be of the "air-blast" type, working at (say) one to two pounds per square inch air pressure. With air under pressure crucible furnaces will melt all kinds of metal up to the melting-point of pure nickel—1452° C. "Muffle" furnaces are also extensively used for firing glass and for enamelling processes. Brass, gun-metal, and aluminium on an average require:

(*a*) Starting from cold, 6 c.ft. of gas per lb. of metal melted
(*b*) Second heat, 4 c.ft. of gas per lb. of metal melted.
(*c*) Third and subsequent heats, 3 c.ft. of gas per lb. of metal melted.

Gas-fired steam-raising boilers are made in a variety of sizes upward from, approximately, 100 lbs. evaporation per hour. These boilers are unrivalled for laundries, cleaning and dyeing works, printing works, and for general heating processes, owing to their cleanliness, ease of handling, and unequalled efficiency. They raise steam to about 120 lbs. pressure per square inch from cold water in about 30 minutes, and require on an average, approximately, 2½ to 3 c.ft. of gas per lb. of steam evaporated.

Turning now to the confectionery trade. Sugar boilers are very extensively used, and have proved themselves a sound business proposition. The laundry trade also is well-equipped with gas appliances in the form of internally heated gas-irons and a very useful collection of high-pressure burner adaptations for laundry purposes, such as shirt and collar machines, &c., which are finding increasing favour with launderers. In my own town we have several installations, and have recently re-equipped a large laundry throughout with high-pressure irons and adaptations.

We also have a range of high-power burners which are very useful for a variety of trade purposes. In Croydon we have satisfactorily employed them for bitumen melting, a process in connection with the manufacture of linoleum, and oil rendering—one of the steps in leather dressing. These burners can be employed for the conversion of solid-fuel furnaces to gas heating, by making some small structural alterations to the setting of the pan, &c., and the flueways.

Then we have the various types of blow-pipes, internally heated soldering irons, tinman's stoves; and so one could go on multiplying these industrial appliances.

Our country has enjoyed its years of prosperity much by reason of its coal supplies. This—one of our most valuable national assets—is dwindling all too quickly. The supply will last our time. Indeed, it is estimated by authorities on the subject that, at the present rate of consumption, the supply will hold-out for 200 years; but is it not our duty in this generation to provide for the future well-being of those who are to follow us? It is a qualified scientific fact that the present method of using coal in its crude form, either in domestic grates or in factories and electricity works for steam-raising purposes, is a pitifully wasteful and destructive process. All the valuable bye-products are lost in the form of smoke emitted, to the detriment of health, vegetation, and structures. It is a lamentable thing to have to record that the life-giving properties of the sun are withheld from mankind, largely on account of its invigorating rays being prevented from reaching the earth by smoky fog-banks. It is significant to note that about 20 million tons of coal per annum are utilized in the United Kingdom for the purpose of gas manufacture, whereas nearly 40 million tons are consumed annually for domestic purposes, and (say) 120 million tons for industrial processes.

Looking at the domestic aspect alone, the maximum efficiency attained by coal (when burned in its crude form) may be assumed at 20 p.ct. This is a very high figure; an average result is probably nearer 10 p.ct. Sir Dugald Clerk computes the efficiency of an open coal-fire at 8 p.ct. With the economies which the gas industry are now able to effect in gas-making processes, consequent upon the recent revision of legislation, coupled with improvements in gas appliance construction, coal converted into gas would yield a net efficiency (when utilized in consumers' appliances) of about 40 p.ct. In addition to this vast saving of thermal energy, it must also be borne in mind that bye-products of important commercial value would be saved, and we should be living in a cleanly atmosphere, with the sun at full liberty to fulfil its functions.

Discussion.

Alderman F. Templer Depree (Exeter) having paid a tribute to the two authors and to the Association for bringing the advantages and benefits of gas before the public, commented upon the very large number of employees of the Southampton Gas Company who had attended the conference. It was of immense value that the men who were helping in the interests with which they were associated should have the opportunity of hearing such papers, and of obtaining information which would be of value to them. He drew special attention to this, because at some of the previous conferences the gas companies had not adopted this plan, which was essentially a good one. The advantage of the use of the therm in the gas industry was going to be to the public, and not to the companies. This was a very important item. The advantage of gas for motive power was not merely in the reduction of cost. His firm had now something like twelve or fourteen gas-engines at work; and they were able to shut-off the motive power at will in any department, whereas previously when they were employing steam power they had to keep it going for the entire works, though they might only desire power for certain portions.

Lieut.-Col. H. W. Woodall said that in his opinion there was nothing more harmful to the gas industry than to supply apparatus which was not absolutely suited to the purpose for which it was to be used. Far better would it be to let their competitors get in, and utilize apparatus of their own, if it was more suitable than other which was not going to give satisfaction. So far as in their power, they had endeavoured to give good service; and this was much the best policy. It was no use for them to "rest on their oars" and to be satisfied with what they had already accomplished. It was no good saying: "We have been accustomed to a 10 p.ct. increase in the past; but we have not got that now, because people cannot afford to buy gas." Before they adopted this attitude, it would be very wise indeed to get particulars of what their electrical competitors were doing, and to be quite satisfied that they were in the same position. If they inquired into matters, they would find more often than they would expect that their electrical competitors were going ahead faster than they themselves. The electricians were not standing still through trade depression. There was no need to be depressed by this, because it indicated that there was a very big field indeed for the gas industry to work, if only they had the courage to go out and face the task. They were fully equipped to do it; but he thought sometimes they were a little too satisfied with the position in which they found themselves. Associated with this question was that of publicity; and if it were not for the "B.C.G.A." and the work they had done, the gas industry would not be in the position it occupied that day.

Mr. Mason urged the woman's point of view, and said the greatest service the gas industry and the "B.C.G.A." could render was in the home.

The authors were heartily thanked for their papers; and the audience afterwards partook of tea provided by the Southampton Gas Company.

A SALESMAN'S EXHIBITION.

An attractive feature of particular interest to the selling departments of gas undertakings was the "Salesman's Exhibition," designed by the Association to acquaint visitors with the best and most effective methods of holding and extending their markets in domestic supplies of gas for heating and lighting. Campaign literature, interesting and to the point, and well got up, occupied the propaganda stall. The Association are able to offer individual undertakings a wide choice of excellent matter; and the scheme is worth the attention of the busy manager desirous of tapping particularly the reserves of potential heat buyers. Exhibits of general interest to the consumer included a lump of coal representing the 35 million tons burned in the United Kingdom each year for domestic purposes. This was placed on a much larger cube, which indicated the waste of valuable bye-products by the consumption of raw coal. Perfumes, dyes, retort carbon, pitch and tar, &c., were among sample bye-products shown.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications to the Board of Trade for Orders under the Gas Regulation Act.

SPECIAL ORDERS.

Broadstairs Gas Company.

The Company are applying for a Special Order to authorize them to construct and maintain gas-works on land described, to increase the borrowing powers, to establish profit-sharing, and for other purposes.

Wellingborough Gas Light Company, Ltd.

A Special Order is being applied for by the Company, to make provision for raising further capital, to authorize the purchase of land, and to make regulations regarding the supply of gas, to enable employees to acquire shares or stock, and for other purposes.

DECLARATIONS OF CALORIFIC POWER.

Bognor Gas Light and Coke Company.—475 B.Th.U. (March 31).
British Gas Light Company, Ltd. (Trowbridge).—500 B.Th.U. (March 9.)
Crossgates, Halton, and Seacroft Gas Company, Ltd.—550 B.Th.U. (April 1.)
Gravesend and Milton Gas Light Company.—425 B.Th.U. (March 25.)
Haywards Heath District Gas Company.—425 B.Th.U. (March 20.)
Kenilworth Gas Company.—400 B.Th.U. (March 25.)
Lymington Gas and Coke Company, Ltd.—450 B.Th.U. (March 13.)
Mirfield Gas Company.—500 B.Th.U. (March 31.)
St. Helens Corporation.—475 B.Th.U. (May 31.)

WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS COMPANY.

The Ordinary General Meeting of the Company was held on Tuesday of last week, at the Cannon Street Hotel, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. Charles W. Braine) read the notice convening the meeting; and the Directors' report and the statement of accounts for the year ended Dec. 31 were taken as read.

A BETTER DIVIDEND.

The CHAIRMAN, on rising to move the adoption of the report and accounts, said that the first point to which the Board would like to address the attention of the proprietors was the fact that, after years of depression, they were at last able to give the proprietors—he would not say a good dividend, and he did not know that it could be called even a decent dividend—but a better dividend than in the past few years, though it barely amounted as an average on all the stocks to 5 p.ct. When it was remembered that the banks had lately asked as much as 7 p.ct. for lending money, it would be recognized how hardly the proprietors had been treated in receiving only 3 p.ct.—thanks to the war.

AN ILL-JUDGED STRIKE.

The dividend now recommended would, of course, have been much larger, but for the most ill-judged, unnatural, foolhardy thing that had, perhaps, ever occurred in the history of the world—the miners' strike, which was not repressed, as it should have been, by the "powers that be"—the powers that did not govern, though they should do so. Had the proprietors heard the cheers of the Company's men when they saw a ship coming from France with some of the worst and dearest coal, but which was necessary to help them to keep going, they would have understood how much the heart of the people was against the strikers. Thanks to the gas companies all over the kingdom, people got, during this trying period, something to cook their food and warm themselves with, which otherwise they would have been without. With their "T.N.T" and other things, the gas companies saved the nation during the war; and again they saved the community last spring, when they gave them something to burn. It was very bad gas; but the Company could not make better in the circumstances. It was also very dear; and it was costing the Company for about six weeks 2s. per 1000 c.ft. more than they were being paid for it. This explained why the dividend now recommended was not better. This extra 2s. per 1000 c.ft. they had to pay had afterwards to be obtained by further raising the price of gas. It had already been raised in the spring by 6d. per 1000 c.ft.; but they had to put it up rather more than 9d. to pay for this very bad stuff that they were forced to use by the ill-conduct of their own fellow-countrymen, who were so proud to work in the mines that they would not work. This was the position in regard to the dividend.

REVISION OF THE STANDARD PRICE.

The next thing the report told them was that the Company obtained an Order from the Board of Trade whereby the standard prices had been revised; and this explained why the proprietors were receiving, instead of the 3 p.ct. they had been getting, nearly 5 p.ct. on the average. This was because of the wise action of Parliament, prompted very much by some Labour Members, who insisted that the shareholders ought to have some fair return for their capital while the workers were getting higher wages. He heard himself, in the Grand Committee who sat on this question, a Labour member speak up like a man, and say: "We working men are getting better wages; but our employers are not getting a fair return for their money." A very capable gentleman was appointed, who re-adjusted this hardship for them. Practically what he did was to raise the standard price on which the dividends were based from 4s. per 1000 c.ft. (which was a very fair rate thirty years ago) to 6s. 6d. (which was quite a fair rate to-day). The prices of commodities of all kinds were practically double what they were before the war; but the Company were not given double. They were given 2s. 6d. on 4s., which was not a very large increase, but was sufficient to enable the Directors to give them the increased dividends which were set forth in the report, and which they must consider fairly satisfactory after their bitter experience of almost starvation of return on your capital.

THE THERM BASIS.

This change in their standard price had been allied with another change in the method of describing the gas. There had been invented a new term—derived, he supposed, from the electricians; he did not know where else it came from—called the "therm." This was very simple, after all, because it was easy to convert therms to cubic feet or cubic feet to therms. They had now to speak of gas in therms, and then to convert the therms into 1000 c.ft. As a matter of fact, the Company ten years ago took a Bill by which the old standard of sperm candles was converted into therms, so that it was only a change from "sperms" to "therms," and there was practically nothing in it, except a certain amount of mystery to people who did not think much, or who thought too much of very small things. The drawback to the introduction of this new term was that all their "back-sights," as an engineer called them, were destroyed. There was no sort of comparison to be made for a year or two between accounts presented in therms and the past practice of my 45 years as an engineer of presenting them in thousands of cubic feet of gas. There was nothing else in it. Formerly they had to supply a certain value in sperm candles; they had to be honest. The gas was tested by the authorities, to see that it was of the right quality; and in future it would be similarly tested by them for its heat value. It made very little difference to the Company whether they manufactured 14-candle gas or the same thing under another name.

CAPITAL POWERS OF THE COMPANY.

The next paragraph in the report dealt with the capital powers of the Company. Their Bill gave them larger capital powers which he thought, when they had heard what he had to say on the subject, they would agree with him were absolutely necessary. They owed the bank £420,000; and the bank did not like this. The bank would like it even less now they got 4½ p.ct. than when they charged 7 p.ct. Besides that, the Bill increased the area of the Company—especially at Epsom, which was a rapidly developing place; and there were other useful provisions which gave them more scope in other places.

POINTS FROM THE ACCOUNTS.

Now he would tell them something about the details of the accounts. It was quite impossible to compare these figures—with the big strike to which he had referred—with any previous figures in the history of the Company. They had the European war for five years before the strike; and then there were the three months of civil war, which utterly destroyed all prospect of economy in working. With regard to the capital account, they would be gratified to see that, while they spent £35,000 on buildings and plant, meters, stoves, and things like petrol-lorries, and barges, and so on, they wrote-down by depreciation meters and stoves by £29,000; so that the net addition was only £5968. As the report told them, the increase in the sale of gas was *nil*. On the contrary, there was a decrease of 4¾ p.ct. for the first time in the Company's history. Therefore it was a wise thing not to spend too much money when they were losing their sales of gas. The next thing that struck him in the accounts was that the coal which they usually got for about 20s. per ton had this time cost them as near as might be 51s. per ton.

APPRECIATION OF PROFIT-SHARING.

The accounts contained another item on which he wished to dwell, and that was profit-sharing. This was a bonus system given to their workmen; and it would have been double the amount but for the strike compelling the price of gas to go up, because it was another of the late Sir George Livesey's provisions that, if anything happened so that the consumer had to pay more for his gas, the shareholder must take less dividend, and the workman get a smaller bonus. The strike had altered the accounts very much to the workmen's detriment. Their men were working uncommonly well now. During the war they had to take on a lot of indifferent men, who could not earn anything in any other way, and who worked exceedingly badly—their main object being to draw wages and do as little work as they could. No doubt they had all noticed this sort of thing in connection with the housing schemes—houses costing £1300 or £1400 which could have been put up formerly for £300, but that the men would not work, and nothing could make them. He might say that this profit-sharing of theirs had always been on a rather meagre scale; and the Board would be considering presently the whole question of profit-sharing and the basis of it. He hoped that when next they met the proprietors they would be able to report that they were giving as a stimulus to the men something that would really have the effect of stimulating them, and which would not be so insignificant as the £2000 figuring in the accounts now submitted. Certainly, better men a company could not possibly have. They were adopting all kinds of new practices and processes, for which they were indebted to the co-operation of their Engineer and the most hearty and thorough-going support of the men. He could not speak too highly of the staff and the employees generally.

GAS PRICE AND DIVIDENDS.

Before he left this question of the bonuses, he wanted to say that up to the middle of 1917 the Company were charging the lowest price for their gas of any company anywhere in or about London or the southern district. There was no reason why they should not. They had a splendid district and a very fine property. They had elements in their capital account that very few companies had. They had a fleet of ships and barges; and they had a derrick on the river—quite an unusual property for a gas company to possess, but a very profitable one. The time was therefore not far distant when they would again be supplying gas at the lowest price in London. He said this with every confidence, and as a result of a very long experience of the gas industry—for at present he thought he was the oldest practising gas engineer alive. He assured them that they would go back to the lowest price. The advantage would be that the dividends of the proprietors would go up. Down would go the price of gas, and up would go the dividends and the workmen's bonus. At present they were not charging the lowest price, because the strike compelled them to raise it. They could not help it. They had to get something out of the supply of gas; and with coal at the price they were obliged to pay through the strike, there was no other way out of it. But they had already withdrawn from this position, and were charging a level price with the rest of the companies in London, bar one, and they meant to get down to that one. He assured them that they did, and that they would succeed before long. The calculations of their Accountants, and the figures that were before them, backed-up by the ardent wishes of the Board, who were all resident in the various districts served by the Company, looked to him very much as if they would make the consumers a present after next June of something like £70,000 or £80,000 at least; and this would give them nearly another 1 p.ct. on their stock. In fact, in the present half year they would be entitled to another 12s. 6d. p.ct., because they had put down the price of gas to a figure which entitled them, under the sliding-scale, to five-eighths of 1 p.ct., or 12s. 6d. The Directors would increase this very considerably, and, he hoped, give them seven or eight half-crowns further in the December half of this year. ["Hear, hear."] He thought it was well to state this boldly and plainly, because, as he had said, the price of gas in consequence of the strike was simply appalling to old campaigners like himself, who had never seen anything like it; and it had naturally produced a certain disturbance in the minds of the consumers, who were not to-day burning gas as freely as would be the case if it were cheaper. There were small reductions in the daily sales, which showed that they were not contented, even at the present price, which was lower than in the last half year. The Board must direct their attention to this matter, because they lived by their consumers, and must give them gas of the price and quality they wanted.

THE NEWSPAPER SCARE.

Speaking of quality brought him to the consideration of another question which had recently been alluded to by the Chairmen of every gas company of this importance in London—that was the scare that had recently been raised at the instance, he thought, of an eminent

chemist in the South of England, as to the existence in the gas of a deleterious product in the form of carbon monoxide. Well, no gas had ever been made yet that did not contain some of it; but they must not allow themselves to be led away by a scare. There was an accidental death of a jockey the other day in a bathroom, where there was no outside element that had introduced carbon monoxide. It was pure gas. Then a man in their own district had gone to bed with a gas-pipe in his mouth. It was a most determined case of gas poisoning; and he died, as might have been expected. If a man was determined to destroy his life, there was the River Thames; there were railways to run over him; there were prussic acid and every variety of poison. Their great rivals, the electricians, had got a death list from wilfulness or accidents that would paralyze any body of gas shareholders to think of. If people did not breathe the gas, it would not hurt them. They should see that their stoves were properly ventilated, and above all should not breathe it. They should cook their food with it, and warm themselves by it; but they should not breathe it. The consumers must remember that it was to the Company's interest to serve their interests. If there was no economy in this thing, he would not supply another cubic foot of it; but there was economy in it. It was a question for the consumers. If they preferred a little more immunity rather than economy, they must have it.

THE PENSION SCHEME.

Again speaking of the workmen, the Directors had also given effect to a very valuable pension scheme for them; and some twenty or thirty of their old servants who had a pension had been treated in accordance with this new scheme. Though they had not earned it, so to speak (for the scheme was an absolutely new one), it was thought only wise to put those who had been on the old basis into the same class as they would have been entitled to occupy in ten or fifteen years under the pension scheme. This scheme arose out of another very useful method the Company had adopted. Three of the Directors—one of them a valued member of the South Metropolitan Board, another of them a member of the Mitcham Gas Board, and the third connected with the founder of this very Company in Wandsworth—met the workmen at stated intervals for the discussion of all matters connected with the workmen's comfort; and he could not describe to them how smoothly and how well this committee or conference had worked, and its good results in the progress of the Company's operations. Indeed, he thought a large part of the commendatory observations he had made a little while ago about the good service of their workmen was greatly due to the influence of this Committee, and to the advantage of obtaining the other man's view. It was always valuable to have the views of the man "on the other side of the table." That had given rise to the perfection of this pension scheme; and he thought it must give rise to other improvements in the circumstances of the employees generally that would be to the advantage of the shareholders as much as to the men themselves.

CAPITAL POWERS.

When they looked at the capital account, which led up to the special meeting now to be held, they would find that the Company had overspent their capital by no less than £200,000; and they owed their bankers £422,000. They would thus see the advantage of what it was proposed to do. For some time they were paying 7 p.ct. to the bank, while the stockholders were only getting 3 p.ct. It would have been wise if they had lent the money to themselves out of another pocket. When the Directors started raising this capital—which they would do by mortgages, at a good rate of interest—it would be to the interest of the proprietors, and he implored them to avail themselves of the opportunity, to take up these bonds, because the interest would be larger than they were getting immediately on their ordinary stock. If they allowed an outsider to come in and take up these bonds, which must be in the neighbourhood of 6 p.ct., he would walk off with the plums, while the present proprietor would have to be content with the chestnuts in his moderate dividend. He had advocated this course at several other meetings. It must be to their interest, as money had to be borrowed at a high rate, to get this price, and so average their return. They had already been paying the bank for the £422,000; and it would cost them hardly any more to pay themselves instead. The capital would be issued in the manner that seemed best to the Board; and the best manner appeared to them now to be to issue it in small lots—not too much at a time. They had been seven or eight years piling-up this £422,000; so they might take two or three years to pay it off. Small issues might be made just after the proprietors had received their dividends. He had spoken to them very prosaically, in ordinary language—without maintaining scientific terms or talking of high finance—but he would be glad to give any further explanation that might be desired.

The DEPUTY-CHAIRMAN (Mr. R. Garraway Rice) seconded the motion, which was at once carried unanimously.

THE DIVIDENDS.

The CHAIRMAN next proposed the declaration of dividends, less income-tax, for the half year ended Dec. 31, at the statutory rates per annum, as follows: On the Wandsworth "A" stock, £6 12s. 6d. p.ct.; on the Wandsworth "B" stock, £5 2s. 6d. p.ct.; on the Wandsworth "C" stock, £4 12s. 9d. p.ct.; on the Wimbledon stock, £4 10s. p.ct.; on the Epsom stock, £5 p.ct.; and on the new ordinary stock, £4 12s. 9d. p.ct.

The DEPUTY-CHAIRMAN seconded this; and it was agreed to.

RE-ELECTIONS.

On the proposition of the CHAIRMAN, seconded by Mr. H. S. FREEMAN, the retiring Directors (Messrs. R. Garraway Rice, J. B. Howell, F. H. Jones, and B. R. Green) were re-elected.

The retiring Auditor (Mr. E. L. Burton) was also re-appointed, on the motion of Mr. J. C. POTTER, seconded by Mr. W. RICHARDS.

Extraordinary Meeting.

The CHAIRMAN said they now came to the Extraordinary Meeting, at which formal resolutions were to be submitted to enable the Directors to get the money they needed in the cheapest manner they possibly could. While moving the resolutions, he would in the same breath implore the proprietors, when the capital was offered, on more advantageous terms than were practicable to-day on the old capital, to avail themselves of the opportunity of getting hold of some of the stock. It would be issued in small lots, so that there would be a chance for all. It would be offered to the Company's employees also; and people in the district who were consuming their gas might as well have a share. The Board would endeavour to arrange this. He begged to move the first resolution:

> "Resolved that the Directors be and are hereby authorized to raise from time to time the sum of £289,478 13s. 8d., being the amount of the capital of the Company authorized by the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, and remaining unissued, by the creation and issue of stock, not exceeding in amount, with premiums (if any), the afore-mentioned sum, in accordance with the provisions of the Company's Acts, and under such terms and conditions as they may find to be expedient."

The DEPUTY-CHAIRMAN seconded the resolution, which was carried.

The CHAIRMAN said that, of course, they were limited as to the amount they could borrow by the ordinary stock. He moved:

> "Resolved that the Directors be and are hereby authorized from time to time to exercise the borrowing powers of the Company by the creation and issue of redeemable or irredeemable debenture stock and/or by borrowing on mortgage of the undertaking sums amounting in the whole, whether by debenture stock or mortgages, or partly debenture stock and partly mortgages, to one-half of the amount of the capital for the time being which at the time of borrowing has been raised; and that such debenture stock or mortgages be issued to such persons on such terms and conditions, bearing such rates of interest, and at such prices, and to be repayable on such date or dates as the Directors may think fit."

The DEPUTY-CHAIRMAN seconded this; and it was at once agreed to.

VOTES OF THANKS.

The CHAIRMAN, referring to the promptness with which the various resolutions had been unanimously agreed to, said he had never seen a finer lot of shareholders. [Laughter.] Before closing the meeting, he had one other pleasant duty to perform. He had already spoken of the great services of their workmen, and of their loyal and industrious efforts in the interests of the Company; and in these remarks he included the staff. Now the time had come when the proprietors should convey their appreciation of this good service by passing a very hearty vote of thanks to the staff and workmen. At present they lived in times of great change in many ways. There were people supplying gas of 400 B.Th.U., and others of 550 B.Th.U., while between the two there were scores of different figures; and it was for the engineers and directors to keep a vigilant eye on these various suggestions and degrees of standards, and to ascertain by what means the supply of gas to the consumer—or the supply of heat, which was the same thing—could best be regulated and administered. Since Sir George Livesey introduced his incomparable sliding-scale legislation, by which the consumer had to be studied, and further introduced his incomparable co-partnership arrangement, by which the workman himself had an object in cheapening the supply of gas to the consumer, the legislation had become so perfect that, even if the Board and officers conspired to do anything irregular, they could not take more profits until they had given the consumer his share. This share was generally something like five-sixths, and in the case of their own Company it was as high as nine-tenths. That was to say, the ratio of addition to the dividend was only one-tenth of what the consumer must receive in the shape of a reduction in price. The proprietors knew that this was true, because they had felt it during the last three or four years. When the war forced the price of gas up, the dividends went down. Did not they consider this a wise provision? His old friend, who had now been in his grave for many years, was a far-seeing man when he hit upon these two devices. If there had been a profit-sharing system with the miners getting the coal, they would not have left their work. But now when the price of coal went up, the men's wages went up; and the easiest way to make the price of coal go up was to bring none out of the pits. A wiser and a better principle than that of offering the shareholder and the workman a higher return for his capital and his labour by reducing the price of gas to the consumer, he had never come across in the whole of his career. ["Hear, hear."] He was sure they would pass with great zeal this vote of thanks to the Secretary, the Chief Engineer (Mr. C. M. Croft), their assistants, and the workers generally.

Mr. MAITLAND said that, as a very old shareholder, he would like to second this. He heartily approved of all the Chairman had said.

The vote having been cordially passed,

Mr. C. W. BRAINE, in acknowledgment, assured the meeting that everyone did his best to further the interests of the Company. They appreciated the fact that they worked under such a leader as Mr. Jones, who was easily first in all matters relating to gas. He had now served 27 years as Secretary of the Company, and wished he could have the opportunity of serving another similar period. The future of gas, no doubt, was very bright; and those who were young would live to see it.

Mr. C. M. CROFT, who also returned thanks, said he did not think anyone was blessed with a better body of men or a more able and loyal staff than he had got.

Mr. C. E. NUTHALL said he would like to voice the thanks and congratulations of the proprietors to the Chairman and Directors for the way in which they had conducted the business of the Company during the past year. They had had a very trying experience for some time past, and had had many troubles to contend against. They had all listened with the greatest possible interest to their worthy Chairman, who stood so high in the gas profession. It was very interesting to have things explained to them in so lucid a manner. The consumers as well as the stockholders should be very well satisfied with the results, considering the difficulties that had had to be met. He had been a stockholder in all these Companies before they were combined; and he did not quite fall in with the idea of amalgamation when it was suggested. But now it had come about, he hoped that the combination would be to the

benefit of all of them. The future was bright; and they could look forward to still better times.

Mr. PRICE seconded the vote, which was heartily accorded.

The CHAIRMAN said he appreciated very much the remarks of the proposer of the resolution—coming, as they did, from a gentleman who had had experience in the conduct of similar undertakings.

LEA BRIDGE DISTRICT GAS COMPANY.

The Annual Meeting of the Company was held at the offices, Nos. 63 and 64, Chancery Lane, W.C., on Tuesday of last week—Mr. A. M. PADDON presiding.

The SECRETARY (Mr. Richard Sandell) read the notice convening the meeting,

EFFECTS OF THE COAL STRIKE.

The CHAIRMAN, in moving the adoption of the report and statement of accounts, said that the Directors' report could not be fully understood without a somewhat careful examination of the different items and without bearing in mind the incidence of the adverse circumstances which existed throughout the year. As they would realize, the results of the coal strike were reflected in the accounts, but not perhaps very obviously. The effect of the coal strike on different gas undertakings varied considerably. The largest London company had said it represented a loss of £500,000, while the second largest London company had sustained a loss of £350,000; and as they came down to the smaller companies, so the severity of the incidence varied. The Lea Bridge Company had to buy a considerable amount of coal at increased prices; and it turned out to be of very inferior quality. The direct loss must represent something like £2000 or £3000 at the very least; but the loss could not be computed by taking the extra cost of the coal. In some cases comparatively good coal was obtained; in others it was positively worthless, not only were they paying £5 a ton for what cost 50s. per ton previously, but they obtained little or nothing from it in return. Therefore, what he might call the indirect damage accruing from this strike was very difficult accurately to estimate. Notwithstanding all this, he believed they would regard the result of the year's working as satisfactory from the proprietors' point of view. Coming to the report in detail, the first paragraph referred to the coal strike, with which he had already dealt.

CHARGING BY THE THERM.

The second point was with regard to the change from the 1000 c.ft. basis of charging to the therm basis; and the following paragraph recorded that the meetings of the Company would be held yearly in future instead of half-yearly as hitherto. Then came a reference to the price of gas, and, notwithstanding all the disabilities and difficulties to which he had referred, the highest price charged was 1s. 2d. per therm, which was much higher than the Directors wished it to be. It was, however, reduced at the end of the year to 1s. 1d. per therm; and he was glad to be able to say that a further reduction had been announced which would bring it down to 1s. 0½d. per therm. Having regard to the fact that this was 2½d. less than their important neighbour, who now surrounded them on every side, the consumers could not but feel that it was a very satisfactory charge. It was hoped, however, that as there was a further development in the decreased cost of materials, they would be able to advance this good work and reduce the price again. Of course, the Directors were not in a position to commit themselves in that regard; but what had been done was sufficiently an earnest of the Directors' policy, and should make it perfectly obvious to the consumers that they would have transmitted to them every possible benefit that accrued in the ordinary course of events.

THE CAPITAL ACCOUNT.

Looking at the accounts, it would be seen from the statement of capital that the Company had ample statutory powers to deal with the increased development of the business, although that development was more or less continuous. Last year was the first during his connection with the Company (which went back 23 years) in which they had to record a decrease in the output of gas. It was, however, a small decrease; and really it was not a decrease at all, when it was remembered what a very large portion of the business was carried on by the prepayment system, and that it involved a certain amount of estimate of the position during any particular period. Moreover, when they, on the Directors' side of the table, tried to estimate, they kept on the conservative side; and it might be that any little loss made in this respect last year would be found more than made-up during the present year. A very healthy increase had been going on since the beginning of the year, and the Company had got back into its old progressive stride. That, of course, would mean capital expenditure in the future; but they had ample powers to meet any demands that might be made upon them. In regard to the capital account, the most interesting figure was the amount of capital employed in relation to the business carried on. This could be estimated in three different ways. It could be estimated on the amount of capital expended upon the business of the Company. Many people said this was the proper way; and on that basis the figure was £523 per million—a low figure. If it were estimated upon the nominal capital raised, the figure went up to £542; but to this nominal capital there was a certain amount which was added as conversion very many years ago when the stocks were reduced down to the 5 p.ct. ordinary level. The consequence was that there was a certain fictitious value in that figure. In his opinion, the real proper common-sense basis on which to estimate the capital per million was the capital actually received, without any question of adding anything on change of the value of the stock; and on this basis the figure was exactly £500. This was an extremely creditable figure for a Company of this size, especially after having gone through the period of the war, when they had to pay £3 where formerly they had paid £1.

NEW MAINS AND UPKEEP OF WORKS, &c.

Some £34,000 was spent on new mains during the year. This was a very big figure, and was associated with a certain amount of regret in the minds of the Directors because the work had to be done. It represented to a certain extent deferred extensions owing to the period of the war. If the work had to be done to-day a saving of some £15,000 would have been effected; but the mains had to be laid when they were. They were not masters in their own house indefinitely. They had statutory obligations to perform; and the work could not have been deferred. It had, however, brought the Company a great deal of business, and the significance of it was that the expenditure would bear fruit for ten or twenty years. Such an expenditure might have given the capital an ugly push; but it had not done anything of the kind, because the Company had met this expenditure and still had the low figure of £500 per million. As regards the revenue account, the first four items—viz., sale of gas, public lighting, meters, stoves and fittings—represented an increase of £33,000 over the previous year; but £13,000 of this was lost on account of residuals. This, of course, they could not help; but the net increase for the year was £20,000. On the other side of the account, this sum was accounted for by an increased expenditure of £12,500; and there was £8000 extra for profit—a satisfactory disposition of the surplus they would all agree. Repairs and maintenance represented an expenditure of £39,637 This covered everything that could be required in that way; and the mains, services, and meters had been maintained at the full rate and, indeed, it was such an adequate figure that it made up a good deal of lost ground. In this respect, therefore, it could be felt that the effects of the war had been dissipated, and that they had got back into a normal and thoroughly efficient state of things. Having regard to the outcome of the general working, there were several heavy items in the accounts to which attention should be drawn. Some of them would recur and some would not; but whether they recurred or not, it showed that the Company had been able to meet them while giving a perfectly satisfactory return to the proprietors. A sum of £1500 had been taken out of revenue for the Benefit Fund—and very properly so, if the Company were to maintain satisfactory relations with their employees; but, unfortunately, it had not been possible to keep the Fund up in former years. It would be seen that the Company had charged themselves with the expenses of the issue of debenture stock (£650). Strictly speaking, they might have avoided this; but it would not have been good finance. The latter, however, was a non-recurring charge. Then there was the Special Purposes Fund (£2700). Coming to the profit and loss account, there were heavy charges and income-tax and interest on debentures; and having brought £4728 into the account, they carried forward £7664, or nearly £3000 more, after meeting these very heavy charges. There were only a few other items; but such as they were they went in support of the statement that the year had been a satisfactory one. In the general balance-sheet, there was an item Retorts Renewal Fund (£8122). This was an accretion in order to meet expenses that must fall upon the Company in connection with the newer form of carbonizing, which did not need expenditure month by month, or even year by year; but it was apt to fall heavily upon the Company suddenly when it did come. These new retorts were like the "One Horse Shay"—they went completely to pieces all at once, and not piece by piece. Although with a well-designed carbonizing plant they would avoid repairs and renewals for a considerable time, they were none the less when the time did come for repairs and renewals to be made. Therefore it was prudent to set aside money for the purpose. This year they had done this in ample measure, which was good policy and good finance. On the other side of the general balance-sheet, £24,000 was shown as investments; but this was an under-statement of the real value of these investments. When the value of investments went down, the proper and wise policy was to write them down in the books; but when the value went up, it was not written-up, and so this £24,000 was a conservative estimate of the value of the investments, and they would realize considerably more if they were sold to-day. There was also £18,000 on deposit.

A REDUCTION IN PRICE.

As to the price of gas, he was particularly glad that the Directors had been able to make a reduction, because the Company depended to a very considerable degree upon its industrial load. He had been looking at some figures for the past year handed to him by the General Manager which showed that the industrial use of gas in the area was down by 33 p.ct. This was a good indication of the trade depression; but notwithstanding the falling-off in this respect, which involved a reduction of between 20 and 30 million cubic feet, it was practically all made-up on the other part of the business—viz., the supply for domestic purposes. This was extremely gratifying. In a district like Lea Bridge, Walthamstow, and Leyton the employment of gas for domestic purposes was a use of necessity. It was not a luxury or an indulgent use. The people employed it because they were compelled to do so in their domestic economy. In the case of industrial use, however, that was solely an economical question, because if a firm found that the use of gas led to loss instead of profit, they cut it out. They might be able to exact from the private user what he was compelled to pay by reason of his domestic circumstances; but they would never induce a man to start a business in the district unless he had a cheap supply of gas. Therefore, the industrial load was a useful indication of the efforts that must be made to get the price of gas down, from the commercial point of view; and he was very pleased the Directors had been able to announce another reduction. This was a policy which the Board would continue to follow.

Mr. E. L. BURTON expressed the satisfaction of the shareholders at the very favourable results of the past year's working, and recalled the time when the Company were supplying gas at shillings above the price then charged by the Gas Light and Coke Company. That was something like thirty years ago; and it was not only gratifying but remarkable to be told that the Lea Bridge Company were now supplying at a lower price than the Gas Light and Coke Company.

The report and accounts were then adopted.

THE DIVIDEND.

The CHAIRMAN then moved that dividends of 5 p.ct. per annum and 6½ p.ct. per annum be paid on the preference stock and consolidated ordinary stock respectively, less income-tax, and that £205 be put to the credit of reserve fund, leaving £7664 to be carried forward.

The resolution was seconded and carried.

Mr. A. F. Phillips was re-elected to the Board, and Mr. James Randall was re-elected Auditor.

Votes of thanks were passed to the Chairman and Directors, and to the officers and staff.

Mr. F. W. CROSS, the General Manager, replying on behalf of the staff, said that he would regard the new main that had been laid as his own monument in the Company. He took more credit to himself in respect of that main than anything else he had done for the Company, because he knew it was going to be a good thing for them for many years to come. There had been numerous difficulties, but they had all been overcome, and a very satisfactory report had been presented to the shareholders.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

Employees to Participate in the Profits.

The annual meeting of the Company, at the London Offices, No. 5, Great Winchester Street, E.C., last Wednesday, was preceded by an extraordinary meeting, at which a resolution approving of the introduction of profit-sharing with the employees was submitted. Mr. A. M. PADDON (the Chairman) presided.

The SECRETARY (Mr. E. L. Burton) read the notices convening the meetings; and the Directors' report [*ante*, p. 584] and statement of accounts were taken as read.

The CHAIRMAN, referring to the profit-sharing scheme, said the resolution he was going to ask them to pass was largely formal in its character, because the Directors had already committed themselves to the principle and practice embodied therein. The object of the resolution was to obtain the sanction of the proprietors to the putting in force of a scheme to enable the employees of the Company to participate in the profits of the undertaking as from Jan. 1, 1921. Since the scheme was introduced by them, it had confirmed all the anticipations the Directors had formed with regard to it, and had led them to expectations in excess of the benefits they had already received. It was absolutely impossible for the relations between important undertakings and their employees to continue as they were a few years ago. Something had to be done to place matters on a new basis, and to remove some of the disabilities which had accrued as a result of the disturbed period of the war. The scheme had already established beyond all manner of doubt that it was helpful to the Company.

The DEPUTY-CHAIRMAN (Mr. G. W. Carey) seconded the resolution, which was carried unanimously; and the business of the ordinary meeting was proceeded with.

The CHAIRMAN, in moving the adoption of the report and accounts, remarked that, if any gas undertaking differed from others, he would say it was the Brighton Gas Company, for there were many features which distinguished it. In the first place, they had a not very stable population. Then, though they were not industrial in the nature of their area, if there was industrial depression in any part of the country they always felt the repercussion of it. Their district was also a very scattered one. Further, they had to serve a plurality of local authorities; and the two most important ones were not easy to serve. The Company were not allowed the most profitable portion of the public lighting, but were relegated to the unprofitable back-streets, where it did not pay to supply gas. A well-conducted gas undertaking ought to have a certain share in the public lighting, when it was realized that the best form of public lighting which existed could be afforded by the gas undertaking. The only light suitable for Brighton, however, was apparently that supplied by its own local authority. He mentioned this because he had been the recipient of the most bitter comments upon the lighting of Brighton. He had been assured that it was the worst lighting in the United Kingdom; and he had hastened to say that in no wise could the Gas Company be held responsible for it. But in spite of everything, the Directors had been able that day to bring before the proprietors a very satisfactory account. As was to be expected, there had been a decrease in the sale of gas; and the coal strike had involved them in a lot of expense. They had obtained an Order which increased their borrowing powers to the extent of £132,500; and this was required because the works needed extending and bringing into line with modern practice. Under the Gas Regulation Act, they had declared the value of the gas to be supplied at 470 B.Th.U. No doubt the higher they could put the calorific value, consistent with economical cost of manufacture, the better it would be for the Company; and he thought it extremely likely that they would substitute in the future an even higher figure for the one he had named. He felt sure they would be associated with a large number of other undertakings when they did so. The highest price charged by the Company for gas last year was 1s. 2d. per therm; but this had now been reduced to 1s. 0½d., which was not a bad figure. The capital was only £493 per million cubic feet of gas sold; and this figure was one which gave them a great deal of encouragement in looking forward to the future, when they remembered the large sums that they had spent within the last two years—probably £200,000 in one way or another. The provision for maintenance of works, &c., was adequate. There was an item of £3728 for benefit fund account. It was their intention to build up this fund, because it would have a direct bearing on the co-partnership scheme, the employees looking to it for their pensions and superannuation. Co-partnership took £6591, which no one would grudge, if the system continued to give the results so far experienced; and, as he had said, even better results were anticipated. To sum-up the figures, they brought into account £19,797, and were taking forward £21,249, or £1452 more; and he thought it would be agreed that, in connection with such a troubled period, this was an excellent result.

The DEPUTY-CHAIRMAN seconded the motion.

Mr. H. E. JONES congratulated the Board on their management of the capital account. He could only think how pleased the Chairman's father would have been if he could have seen his son bring the Company to its present position.

The resolution was then carried unanimously, and dividends were declared making a distribution for the year of 11 p.ct. on the original ordinary stock and 8 p.ct. on the "A" ordinary stock.

On the proposition of the DEPUTY-CHAIRMAN, seconded by Mr. H. E. JONES, the retiring Directors (Mr. A. M. Paddon and Lieut.-Col. C. L. Morgan) were re-elected; and moved by Mr. W. RICHARDS and seconded by Mr. JONES, Mr. William Cash was re-appointed Auditor and Special Auditor.

Proposing a vote of thanks to the officers and staff for their services during the past year, the CHAIRMAN said that the Engineer and General Manager (Mr. C. H. Rutter) had been having a very busy time with the reconstruction of the works. This work had been well done; and all the anticipated economies had been realized.

The Chairman and Directors were similarly thanked, on the proposition of Mr. JONES, seconded by Mr. F. W. CROSS.

HARROW AND STANMORE GAS COMPANY.

A Satisfactory Financial Position.

The Ordinary Half-Yearly Meeting of the Company was held on Monday of last week, at No. 5, Great Winchester Street, E.C.—Mr. A. F. PHILLIPS (the Chairman) presiding.

The ENGINEER and SECRETARY (Mr. Charles Chambers) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read. The report, which was for the six months ended Dec. 31, stated that the balance standing to the credit of profit and loss was £14,689. The Directors recommended that dividends be declared for the half year at the rate of 6 p.ct. per annum on the ordinary stock and 5 p.ct. per annum on the preference stock, both less income-tax, leaving £7349 to carry forward. In consequence of ill-health, Mr. S. Cutler, who for many years had given the Company valuable services as a Director, tendered his resignation. To the vacancy thus created, the Directors elected Mr. Samuel Cutler, Jun., Assoc.M.Inst.C.E., M.Inst.M.E., whose experience as a gas engineer would be of great assistance to the Company.

The CHAIRMAN, in moving the adoption of the report and accounts, said that, when they held the last half-yearly meeting, the country had only just recovered from the coal strike, which lasted three months, and cost the Company £3000 extra in regard to coal. Fortunately during the past half year there had been no difficulty in obtaining coal, though the price was higher than the Directors considered it should be. The prices were, however, falling; and their contractors had given notice of reductions which the Board trusted would be followed by further concessions. The sale of gas was 1·71 p.ct. more than in the corresponding period of the previous year, which, in view of the price and all other circumstances, might be considered satisfactory. There had been an expenditure on capital account of £7624, for enlarging the carburetted water-gas plant, new mains, meters, and stoves, from which there was a credit of £3629 for depreciation—leaving the net increase of capital expenditure £3995. The gas-rental was £64,742, against £60,625 in the corresponding previous half year. Products realized £13,702, against £16,064. Less coal was carbonized; coke was sold at lower prices; and the returns from sulphate of ammonia were very small. On the expenditure side, the cost of coal, oil, and coke for the production of gas was about the same as in the previous year—£38,012, against £38,777. Repairs of works cost £10,383, as compared with £9386. All other expenses were much the same as before; and the balance to be carried to profit and loss was £9893, against £8574. After providing for the charges for debenture interest and income-tax, the balance standing to the credit of profit and loss was £14,689. The dividends recommended would require £7340, leaving £7349 to carry forward. Throughout the half year gas had been sold under the Harrow Gas Charges Order, 1921, by the therm at 14·4d., which was 2·8d. below the standard. From Christmas last the price was reduced to 13·6d. per therm. It was hoped, with more favourable contracts for coal, and a reduction in labour charges, to announce further reductions in the future. Revenue, however, was suffering much from lower prices for all residuals, and no benefit resulting from the manufacture of sulphate of ammonia. Considering the time gas companies had passed through since 1914, and the great difficulty there was in maintaining the supply of gas during the coal strike last year, the proprietors might be satisfied with the Company's financial position, and could look forward hopefully to the future. The works and plant had been well maintained. He had visited the works a few days ago, and was pleased with their condition. They were, however, getting near the limit of their capacity; and it would be necessary to make some considerable additions to meet the increasing consumption. Further and larger mains were also required. The district which the Company served was so well provided with railway communication that it was certain to develop rapidly.

The VICE-CHAIRMAN (Dr. J. W. Lee Glaisher) formally seconded the motion, which was passed without discussion.

On the proposition of the CHAIRMAN, seconded by Mr. A. M. PADDON, dividends were declared for the half year ended Dec. 31 at the rates of 6 p.ct. per annum on the ordinary stock and 5 p.ct. per annum on the preference stock, both less income-tax.

The CHAIRMAN said the next duty he had to perform was a pleasant one—namely, to propose the re-election of Mr. Paddon as a Director of the Company. Every year the administration of a gas company became more and more intricate. The introduction of so much machinery, and the many new processes which were being daily studied, made it a most complex undertaking. When recently going over the works at Harrow, he could not help contrasting the conditions now existing there with the system of producing gas (say) twenty years ago. Twenty years ago things seemed to go automatically, with little or no supervision; but nowadays it was necessary to have continually the eye of the expert watching and controlling the many processes which had to be conducted. He felt, therefore, he was fortunate in being able to propose to them that day the re-election as a Director of a gentleman of Mr. Paddon's experience. Mr. Paddon had been a member of the Board for some years; and, as they knew, he had been

trained as a gas engineer, and was also a very able lawyer. Thus he was not only able to render great technical assistance, but his legal knowledge was of vast importance to the Company.

Mr. SAMUEL CUTLER, jun., seconded the proposition, which was carried unanimously.

The retiring Auditor (Dr. Charles E. Goddard, O.B.E.) was also re-appointed, on the motion of Mr. BEAUMONT.

The CHAIRMAN then proposed a hearty vote of thanks to the Engineer and Secretary, staff, and employees, for their services during the past half year. He said they had in Mr. Chambers a most devoted officer, and one who kept his works in excellent condition. The results of his working were perfectly satisfactory. He had under him a capable staff, who also served the Company faithfully.

After being seconded by Mr. HARRIS, the motion was cordially passed.

Mr. CHAMBERS, in acknowledgment, said that happy relations existed at Harrow; and he felt sure they were getting back to something of the spirit of the old days there. They were, in fact, a "happy family." This was his thirty-second year on the works. Having known the district all his life, and seen it grow, he could endorse fully what the Chairman had said as to the future prosperity of the Harrow Company. They had five railways running through the district, with eighteen railway stations. The Company had an area of something like 35 square miles to supply, and nearly 120 miles of mains laid. Within the last two years they had laid mains for four housing schemes, and connected 600 consumers in these alone; and, what was very important, 50 p.ct. of them were all-gas houses. Over the district generally, they had great promise of increase. The increase actually experienced would have been greater but for the slackness in the factories; and when the time came for them to get into normal working again, the increase in gas consumption would be much greater than it was just now.

Mr. A. W. OKE proposed a vote of thanks to the Chairman and Directors, and said he thought one could look upon the Company as a very sound investment. The undertaking had come well through the troublous times. The policy of the Board had been a wise one, ably carried out. They much regretted the retirement of Mr. Cutler, but felt they had found a worthy successor in his son.

Mr. E. L BURTON, who seconded, remarked that the Company were most fortunate in having a very exceptional Board. The technical attainments of the Directors were such that, in their respective positions, it would be difficult to excel them. All were experts, and men of long and proved experience.

The acknowledgment of the CHAIRMAN closed the proceedings.

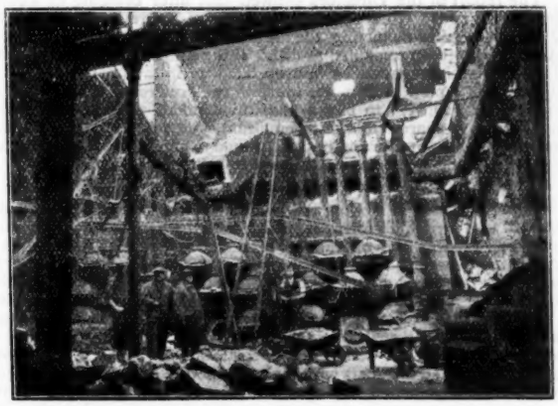
REDHILL AND REIGATE AMALGAMATION.

Mention of the purchase of the Reigate Gas Company's undertaking was made by the Chairman (Mr. W. Lees Stenning, J.P.), at the recent meeting of the Redhill Gas Company. He said that they entered into possession on Oct. 1; and the immediate effect was that the Reigate consumers received a substantial reduction in the price of gas. The whole district would now have a uniform supply and efficient service under statutory control. Looking back to the previous attempt to combine the two Companies, which was made twenty years ago, it was a matter for regret that the community had been denied these benefits for so many years. They hoped to close down the Reigate works for manufacturing purposes within the next few months; and they were already negotiating the sale of plant not required there, and had let part of the premises for a term of years. The first three months' working had confirmed the belief that the methods of manufacture at Redhill were considerably more economical than those at the smaller works. Referring to the coal strike, he said that, thanks to the foresight of their Managing-Director (Mr. W. H. Bennett), they had ample coal, and were able to supply all requirements, as to both quantity and quality. Since October they had supplied gas of a declared calorific power of 450 B.Th.U.; and though the Board of Trade granted them a standard of 16·8d. per therm inside the borough and 18d. outside, they commenced to supply in October at 15·4d. inside and 16 6d. outside. A further reduction of 1d. per therm had been made to all consumers as from Jan. 1. By slightly drawing upon their carry-forward from the previous year, they were able to recommend the payment of the pre-war dividend of 5 p.ct. on the "B" stock. He would like to emphasize the fact that this was less than their standard price per therm would allow them to pay; and he hoped the time might not be far distant when they might be able to improve upon the 5 p.ct. basis. The co-partnership scheme, which was started in 1914, had hardly got into working order when the war commenced. The scale of bonus then laid down soon became inoperative, as the price of gas increased; but they were able to keep the scheme alive by a voluntary contribution to the fund. They gave a promise to their co-partners that, as soon as the new Order became effective, they would reconsider the whole scheme; and now they had embarked upon an entirely new basis—namely, to pay to their co-partners as a bonus a percentage on their yearly wages and salaries equal to the rate of dividend paid upon their "B" stock, such bonus being used for investment in the Company's stock. This would mean a considerable increase on what was previously paid; but they recognized that, whereas the stockholders provided the capital, the co-partners and employees provided the brain and muscle required to make the operations successful. On their cheerful co-operation depended the progress of the undertaking.

Mr. C. F. Myers lectured to the Huddersfield Technical College Chemical Society last week on "The Romance of Coal Tar," dealing with the harassing troubles of the early days, before gas manufacturers discovered a market for the tar, and following on with the important uses to which the products were now put. Of particular interest to chemical students at Huddersfield, Mr. Myers turned to the uses of coal tar and oils in the production of dyes, drugs, explosives, fuels, lubricants, and medicaments.

STORM DAMAGE AT GAS-WORKS.

Gas-works did not entirely escape the effects of the terrific gales experienced during the first few days of last week; and the accompanying photograph shows that the works of the Ventnor Gas and Water Company were among those that suffered. About 7 o'clock on Wednesday morning, a high wall supporting the purifier-house collapsed,



bringing down a chimney, which crashed through the roof of the retort-house, twisting the iron supports, and devastating the roof for about 20 ft. Four men had been attending to the fires, and had left the spot only about two minutes before the roof fell in. The roof had recently been repaired and covered with asbestos; and the damage done will cost several hundreds of pounds to repair. One of the chimneys in falling became suspended by catching a girder; and the removal of this caused some anxiety. Mr. J. S. Ineson (the Engineer and Manager) was soon on the spot, together with Mr. A. Scott (one of the Directors); and a gang of men were set to work to remove the débris.

On the previous day, in a meadow immediately behind the Helston Gas-Works, a very large tree was blown right across the gasholder, making two holes, through which 20,000 c.ft. of gas escaped.

READING GAS COMPANY.

The Directors reported at the annual meeting that the issue of £34,900 7 p.ct. redeemable debenture stock made in July last was largely over-subscribed, and that it was their intention to raise an additional £13,100 of capital at an early date, the amount being required to carry out improvements in the distributing system. The accounts accompanying the report showed that the income for the year was £257,804, and the expenditure £243 544, leaving a balance of £14,260 to go to the profit and loss account. The Directors recommended the payment of dividends at the statutory rates.

In moving the adoption of the report and accounts, the Chairman (Mr. G. W. Webb, J.P.) said that, unlike many places, Reading was fortunate in having a continuous supply of gas throughout the period of the coal strike; but this was only effected at a loss of £14,000 or £15,000 to the Company. To meet this loss, it was necessary to increase the price of gas from Michaelmas; but now there appeared every probability of an early reduction. Unhappily, the coal dispute affected the Company in other ways. The work upon the new vertical retort installation was delayed, as the contractors could not obtain materials; and consequently the plant was not available for use this winter, as had been anticipated. The non-completion was a source of anxiety, as the consumption of gas in the out-districts, as well as in Reading, had increased very rapidly, and the additional manufacturing power was absolutely essential. On the recommendation of their Engineer (Mr. D. H. Helps), the work of enlarging the leading mains had been placed in hand; and when this was completed, and the new plant brought into use, they would probably be able to meet all demands for some years. Despite the industrial troubles, the sales of gas showed only a trifling reduction. They had declared a calorific value of 460 B.Th.U.; and the present price of 11d. per therm was equal to 4s. 2·6d. per 1000 c.ft. The outlook for the current year was, he thought, hopeful.

Replying to a vote of thanks, Mr. Helps said that the public did not fully realize how much they owed to the gas industry for what it did for them. It fulfilled its obligations, but at a very great cost. He would remind them that in many cases throughout the country permits to obtain coal were refused where gas-cookers existed. Unfortunately, the alteration in the method of charge synchronized with the necessary advance in the price of gas; and consumers naturally attributed the increase in their accounts to the change in the method of charge. But it had not—in fact, it could not have—anything to do with the increase.

St. Anne's Gas-Works Transfer.—The shareholders of the St. Anne's Gas Company have agreed to sell the undertaking to the local District Council. The agreement provides for the transfer at a cost of £69,600; the Council taking over all assets and liabilities. The Council will pay £4000 in cash, and issue 5 p.ct. mortgages to the shareholders in the following terms: For 584 10 p.ct. preference shares, mortgages of the value of £20 for each £10 share; for 211½ 7 p.ct. preference shares, £14 for each £10 share; for 704½ old ordinary shares (10 p.ct.), £23 for each £10 share; and for 2075 new ordinary shares (5 p.ct.), £11 10s. for each £10 share.

RADIATION LIMITED.

Ordinary General Meeting.

The Annual Meeting of the Company was held at the Grand Hotel, Birmingham, on Friday last—Mr. H. James Yates (the Chairman) presiding.

The Directors' Report.

The report of the Directors showed that after bringing in £40,753 brought forward from 1920, the balance of the revenue account was £169,078. After deducting the interim dividends (£61,476) paid in August last, there remained at disposal the sum of £107,601, which the Directors recommended be appropriated as follows: To pay a final dividend of 3 p.ct. to Dec. 31, 1921, on the preference shares (less income-tax), £22,837; to pay a final dividend of 3½ p.ct. on the fully-paid ordinary shares (free of income-tax), £48,797; to pay a final dividend of 3½ p.ct. on the partly-paid ordinary shares (free of income-tax), £5297; leaving to be carried forward to next year, £30,668.

The Chairman's Speech.

The Chairman, in moving the adoption of the report and accounts, said: The year which forms the subject of the report now submitted to you as regards the operations of this Company has been one of chequered experiences for most industrial concerns. Not a few firms which are honoured among us have been seriously affected, and Radiation may be regarded as fortunate in being able to show results, which, I think it will be agreed, are in the circumstances very satisfactory indeed. The coal strike, which lasted some three months, was an occurrence which was bound in a special way to affect us adversely, as it interfered so seriously with the manufacture of gas; but the whole year has been a specially trying one for the gas industry. Just as the gas undertakings were beginning to get their house in order after the disorganization due to the war, the coal strike came in to complicate matters, and particularly to delay the reductions in the price of gas which would otherwise have been effected. Once this trouble was over, however, the gas undertakings made a quick recovery; and one finds in the Press almost daily announcements of reductions in the price of gas at various places. This is, of course, bound to have the effect of increasing the sale of gas throughout the country, and this in turn means an increased demand for our apparatus.

War-time Ideas and Post-War Conditions.

But the adverse experiences of industry and commerce during the year are due to causes wider and deeper than the coal strike. The false prosperity engendered by the war has now given place to a condition of extreme trade stagnation and unemployment. This state of things continues unabated; and although there is a somewhat more hopeful feeling about than there was a number of months ago, yet I believe that, if this feeling is to be justified, the position must be seriously considered, and the facts faced by the country, otherwise we cannot have a return to better trade conditions. The idea entertained by so many during war-time, and since, that, once war was over, we might work fewer hours, turn out less work per day, and yet draw more money, has been proved utterly mistaken—proved by, among other evidences, the present vast prevalence of unemployment. Equally mistaken have been the notions widely received with regard to money, and particularly the belief that all that was necessary for individual prosperity was to get a larger amount of income in money—forgetful of the fact (which, although it is an elementary economic truth, is very far from being so well understood generally as it ought to be) that money is in itself merely a measure of wealth, representing the real wealth, namely the things produced by the people of the country, and that when, as at the present time, the quantity of things so produced has become less, then the wealth of the country is decreased to that extent, and that, in these circumstances, though everyone were to have an increased income in money, this would be of little advantage because, while there continues to be no recovery in the rate of production of things available to be bought, the increase of income would be merely nominal. This is illustrated by the fact that Germany has been turning out paper money as fast as her printing presses could do so, and yet it is of little value because it is so depreciated; while America, on the other hand, has more gold than any other nation, but she is suffering from trade depression and unemployment at least as great as our own.

Wages and Output.

As an illustration of the way in which a nominal increase of wages, when accompanied by decreased output, leaves a worker in a worse position as regards purchasing power now in comparison with pre-war conditions, let us suppose that before the war a man receiving a weekly wage equivalent to 10s. per day, turned out ten articles daily, and his daily output is now only five of the same articles. This would bring up the cost of this man's wages on each article, from 1s. to 2s. But let us also suppose that his weekly wage is now doubled. This means that the value of his wage entering into the cost of the article would be 4s. against 1s. pre-war. But the actual wage thus paid to this man for his work on this article is only one of a number of items (including other wages) which make up the total cost that has to be incurred directly or indirectly in its production; and as similarly all these other items of costs would, of course, also be increased in varying degrees, it will be realized what a cumulative increase there is on the actual total cost of the article. Taking this as illustrating the kind of way in which the cost of commodities in general has increased, it is obvious that, notwithstanding that the man's wages have been increased, his pre-war purchasing power has not been increased, but really decreased. Although the particular figures I have supposed are not actual, but are chosen for simplicity, they illustrate the nature of the result, although the degree or proportion of it will vary in each case. It will thus be seen why, though wages have been increased all round since the war, purchasing power is actually less. Those mistaken ideas to which I have referred, as to hours of work and increased income in money, must be got rid of by all who share in the productive capacity of this country, whether by brain or brawn. The first fact we have to recognize is that one thing, and one thing only, can bring back our trade prosperity—output. There is a shortage in the world to-day of nearly everything required for life and comfort; and if there are any who have a fear that the supply of any commodity might eventually come to exceed the demand and unemployment follow, I would say to them, as a practical business man, let us first go on to make-up the shortage of output with a view to bringing back full employment. It will be time enough to deal with any later question of over-production if it should ever arise. So far from increased output per man per hour meaning less employment, the direct opposite is the case. Greater output per man per hour means cheaper production and lower prices; lower prices means fresh stimulus to trade; and this, in turn, means employment for more workers.

Unemployment and Doles.

The unspeakable seriousness of unemployment, especially on so great a scale as at present exists, is a matter which cannot but lie heavily on the minds of all thinking men. Indeed, I am sure no one who has not actually been in the position can fully realize its seriousness. The system of doles may be right in theory to tide starving men, women, and children over a period of unemployment; but it quickly develops into a state of affairs which militates against the possibility of restoring the country to prosperity. The misfortune is that the payment of doles tends, with some men and women, to disincline them for regular work, and becomes itself a new cause of unemployment. A further misfortune is that doles and unemployment pay are going to some sections of the community who were wage-earners in a different capacity altogether before the war, but who have now entered other ranks of service and will not return to their own. Last year I referred to the case of women who were in domestic service before the war, but who were attracted to factory war-work by the high wages then paid and who are now getting unemployment pay. In the great dearth of domestic servants, it may well be asked why these women should now be getting unemployment pay from the Government when they will not go back to domestic service.

The Question of German Reparations.

I have long held the opinion, and have not hesitated to express it, that the workpeople of this country are sound at heart and intelligently desirous of knowing and facing facts. This opinion is based upon 30 years of direct intercourse with them; and I am confident that many of them are now awake to the conditions which have had so large a share in causing the present distressing state of unemployment to the mistakenness of those ideas which have fostered these conditions, and to the fact that only in longer hours, greater output per man, and a will to produce the best articles that can be made, can we find a means of substantially reducing unemployment. We know how greatly business is suffering to-day through the absence of a stabilized condition of the exchanges; and I am firmly persuaded that if the world would settle down to hard work and full productiveness, this would be one of the ways of helping on the stabilization of the exchanges—there is no royal road and no universal panacea. I am equally satisfied that there is nothing to be gained by our clinging to the idea of finding salvation in the matter of prosperity by means of German reparations. Richly as Germany deserves to have to pay in full, it is one of the paradoxes of our complicated international relations to-day that the larger the indemnity Germany pays to us, the more she is liable to damage our own industries. As she cannot pay in gold, she can only pay in goods. If she is compelled to send goods into this country without payment, this, of course, reduces the demand for the equivalent classes of goods of our own native manufacture, and unemployment consequently results. On the other hand, if she sells her goods abroad in greater quantity than heretofore, in order to get cash to pay us, she spoils our markets outside this country—and hence, once more, unemployment results. One thing she can do in the way of reparation is to furnish us with such materials as are not among the natural resources of our country, and also to sell such materials or goods abroad and pay the proceeds over to us. This question of reparations is an exceedingly difficult one, even for those experts who have it in hand. Let us devote our energies to the producing of goods and the recapturing of the markets of the world which we have in a great measure lost owing to the war, leaving the matter of reparations to the experts and not counting upon any help from that source.

The Value of Education.

In the interests of the industry to-day I know of nothing more urgently called for than education. In my own personal contact with workpeople during so many years, I have been impressed by the amount of native talent and intelligence among them, which has been in a great measure baulked of attaining its full fruition and utility by the want of adequate education. It is men conscious of ability, but cramped by the lack of education, who are liable to form wrong views of life and be misled by demagogues to the detriment of the whole community. If these working-men of ability had the necessary opportunities of education—not only education to fit them for their own particular work, but also education in elementary economics—we should meet with far more cases of working-men, by their own talents, reaching high positions of profit and public usefulness, besides a higher standard of general intelligence and enjoyment of life being attained among workers generally, and we should hear less of those crude and pernicious theories that tend to be accepted by many of them. One such theory, for example, of which some elementary knowledge of economics would soon disabuse their minds, is the idea that incomes above those of the average workman are unfair. After all, working men have only to remember that they themselves choose the best men from their own number to be their Union officials; and that they pay these officials—and rightly so—salaries well beyond what men of the rank-and-file among themselves can earn. They do this because they recognize that these men are worth the money; and the same thing applies with the men who occupy positions of management in works—they are worth much more money than an ordinary workman. It also should be remembered that, given the brain and health and a fixed determination to succeed, it is open to any workman to achieve success and wealth. So strongly have I long held these views as to education, to which I have referred, that a year or two ago I was associated with several others in the starting, in a small way, of classes, conducted by University teachers, for men who wished to ac-

quire greater knowledge of economic subjects which—not understanding them nor even realizing their complexity—they had been unconsciously misrepresenting to their fellow-workers. These classes naturally involve expense, and money has had to be collected to enable them to be started in Birmingham. So increasingly successful has the effort proved that similar classes have since been commenced in different parts of the country. There are instances well within my own personal knowledge where men of good natural intelligence, such as I have spoken of, have been able, after receiving in these classes enlightenment on economic subjects, to approach the consideration and solution of difficulties in the works where they are employed with a new and deeper appreciation of the nature of those difficulties and the facts surrounding them; and they have been able to explain these to their fellow-workmen when they were making demands which they did not realize were unreasonable or impossible. As a result, the smooth working of the relations between employers and employed in the various works has been greatly facilitated—to the common advantage of all concerned.

BUSINESS BURDENS.

For example, the men who have profited by these classes have been able to appreciate what it is extremely doubtful if the average working man does appreciate—viz., the proportion, as compared with the workman's own wages, of the costs which the employer has to bear in addition to these wages—*i.e.*, the cost of providing works premises, rent, rates, taxes, &c.; lighting and power, capital to provide plant, machinery, &c.; provision for depreciation of these and of the tools; provision for wear-and-tear and renewals; the provision of the requisite labour to attend to the skilled productive workman; the accommodation and control of the necessary stores for his use; the necessary clerical staff for calculating, making-up, and paying the workmen's wages, for buying materials and for charging the manufactures to the customers, and providing the necessary management supervision, technical laboratory and experimental staff—all these for the works only. It has been found that the aggregate of these various charges, in a large works in which this aspect of the matter was closely investigated, was equal to 165 p.ct. upon the wages actually paid to the workmen—and this without providing a penny for the materials used in the manufacture of the articles, no provision for travellers' salaries or selling charges, no salaries to managers, nor to partners (or—in the case of joint stock companies—directors), no reserve for a rainy day, and no interest on the money which had to be found to build and equip the works and so create employment—but merely provision for the workmen's own wages and the indispensable burdens directly consequent upon the earning and paying of these wages. It would be futile in such a case for anyone to suggest that, because the proportion of these various costs as compared with wages was so large, the management must be extravagant, because the case in question was perfectly normal. But this is a view which too many workmen would be apt to take, through their not knowing or appreciating the facts of industrial management; and yet they might easily find circumstances not wholly dissimilar in the case of the management of their own Unions. I do not say this by way of adverse comment upon the Unions, but quite the reverse, because I have the strongest belief in the Unions as not only necessary for the workmen's interests, but also indispensable in the interest of satisfactory relations between employers and workpeople. I find on looking at published statistics giving the incomes of a number of the Unions that the amount of benefit they pay to their members in actual cash is in some cases insignificant in proportion to the expenses incurred in conducting the business of the Union These charges, in some instances, run to as many as twelve times. I am not criticizing these figures, neither am I suggesting that the cases are parallel; I am merely pointing out that, just as the overhead charges and management charges in manufacture may exceed several times over the actual wages paid, so, in workmen's Union management, the amount of the benefits the workmen receive in actual cash is in some cases disproportionately small compared with the amount of the expenses they incur in running their business or Union. Of course, in other instances the actual cash benefits received are greater than the expenses; but in some of these cases I believe it would be found that this was due to exceptional calls upon the Union funds for unemployment benefits, or strike pay, so that these would not be fair instances of the proportion between benefits paid and normal expenses incurred.

THE BURDEN OF TAXATION.

I now come to a very important factor, and that is the question of taxation. With the corporation tax and an income-tax of 6s. in the pound, a great part of the income derived from industry is not retained in that industry for developing trade and consequently providing employment for the workpeople of the country, but it is spent by the Government in many directions that produce nothing, and it forms a heavy burden on us all—and also it indirectly puts up the cost of everything. The super-tax also, though in itself a charge on private incomes only, is high, and takes possession of a large amount of capital which is spent in the ways the Geddes report has revealed, and produces nothing, instead of being used in industry to the extending of trade and employment. The Government have got to face facts. Their expenditure will have to be brought down to a figure within their income, and that income must be a legitimate one and raised in such ways as not to retard prosperity in the country, and not to cause unemployment. The Geddes report indicates clearly that the fact of such vast sums being placed at the disposal of Government officialdom by these taxes has tended to foster extravagant ideas of expenditure; and the revelations as to the effect of this in connection with (among other things) the Army, Navy, and Air Force are very disquieting indeed. Referring to the Air Force more particularly, we used in this country to consider ourselves fairly immune from invasion because we are an island; but with the advent of the airship and the aeroplane, we have in a great measure lost the advantage of our insular position. Therefore we have to learn to defend ourselves in another way. The conference at Washington has done signal service in showing how our expenditure in Naval matters can be substantially reduced, and no doubt similar economies can be effected in our Army. But as regards the new arm —namely, the Air Force—before anything was done in the way of cutting down expenditure on this, the closest consideration would be required. Indeed, it might be found that expenditure under this head ought to be extended rather than otherwise; but this would only be on condition that the money be so expended that the country receives effective value for every penny, and is placed in so strong a position as to be well able to defend itself against any combined attack from the air. When the war commenced we were not so backward in aviation matters as we had been led to fear; but we had still a long way to go. Nevertheless, true to our national character, we not only quickly made-up the leeway, but were soon well ahead in aeronautical matters. Owing, however, to the want of businesslike methods in our aviation affairs (through lack of control and organization), millions of pounds have been squandered and many matters neglected which are essential to our occupying, as our situation demands, the foremost position in aerial power. The development of civil aviation in the country on proper lines is a matter of the utmost importance in the interest of the National Air Force, as is recognized in the fact that civil aviation is subsidized by the Government.

THE OBJECTS OF RADIATION.

Coming, now, more particularly to the special problems which have to be dealt with to-day in carrying on a business like ours, we are sometimes accused—and this is a matter I have referred to on a previous occasion—of being simply a "Trust" intended for the putting-up of prices. Now, our object in forming Radiation by getting together all the principal manufacturers of gas-stoves in this country was to stop waste and useless expenditure, and to provide the public with goods better made and more efficient; and when they are more efficient, it means you can have your food cooked better, you can have your house warmed more cheaply, and you can get more cheaply another great necessity of life—hot water. Indeed, as I remarked in addressing you last year, without the various kinds of apparatus manufactured by the concerns belonging to your Company, your life and mine would be a very sorry affair as regards material comforts.

PRICE AND QUALITY.

Now what has happened in the matter of prices? In the first place, I am satisfied that if all the advances made by manufacturers in their prices since the war began were carefully to be reviewed, it would be seen that the gas-stove makers had not advanced their prices to nearly the same degree as most other manufacturers. In the second place, they delayed until some time after the outbreak of war raising their prices at all; and on each occasion when they did make an advance, this was not done until it was long overdue. Take the twelve months between June, 1918, and June, 1919—a period during which costs were climbing to such abnormal heights—the gas-stove firms made no advance whatever; so that it would not be just, nor indeed possible, for us to make price reductions on the same basis as manufacturers of some other goods used in the industry. On the contrary, I think that Radiation have in this and other respects deserved well of the gas industry. We have fetched prices down in a way which could not have taken place but for the fact that all the principal gas-stove firms are united as Radiation. It is true that in doing so we have been the means of non-Radiation firms having to reduce their prices also, and in some instances they have, in consequence, not unnaturally, gone below our figure, although, as you will appreciate from what I shall have occasion to mention presently as regards our percentage of profit, this means that they cannot be selling on a profitable basis. It will be readily recognized, however, that the reductions we have now effected, good though these are, do not represent the whole advantage we are able to offer. We have set before ourselves a very high standard of quality and efficiency in all our goods—we will make nothing but the best. Those who want the best class of goods recognize that it pays them in the long run to pay a fair price. The old saying that "the dearest is the best" is sometimes true, and sometimes not. In our case, we are not the dearest, and yet we have got the best. We spend many thousands of pounds a year in research and experimental work. Those who have had anything to do with that class of work know what a large annual outlay it involves. Of course, there are firms who do not incur expense of this kind, but content themselves with copying, as far as they are able, what we introduce, and selling it at lower prices; but it will be appreciated that it is our research work which is the driving-force in the gas-stove industry, and without it we should, as an industry, be left behind, and the whole interests of gas would suffer. In this connection I desire to express my conviction that it is not merely desirable, but essential, that there should be hearty co-operation among all the interests which form the gas industry; I regard this co-operation as the key to the success of that industry.

STANDARDIZATION.

When I last had the pleasure of addressing you, I referred to the great work we had on hand in the standardization of all goods as among the various Companies of Radiation. It is an uphill task; but we have made great headway. When our programme in this direction is completed, gas undertakings will be in the fortunate position of being able to reduce enormously their stocks of parts; their cost of maintaining stoves to the public who hire stoves from them will be considerably reduced; and, owing to the exceptional advantages afforded by the work of this Company—to which I have already referred—the public will have the most efficient and reliable kind of stoves, whether for cooking, heating, or domestic hot-water supply, and those varied types of furnaces which are required in so many industrial enterprises of to-day.

RESEARCH AND DEVELOPMENT WORK.

Before concluding, I should like to cite one instance of the cost which has to be incurred in producing any new type of apparatus on the lines on which, as I have told you, Radiation work. Each of the Radiation firms have in the past spent very large sums of money in their research and development work. One of the firms some ten or twelve years ago started to develop a new type of gas cooking-stove in a way that had not been previously attempted. During this effort many successive types of stoves were made experimentally which were in some respects considerably better than any of the types till then in vogue; but these advantages were neutralized by increased cost of manufacture. Then, just at the time when the entirely new type aimed at had been evolved,

the war came. When war was over, this cooker was placed on the market. Its success was instantaneous; but with the experience gained in its use by the public, it was seen by us that further developments could be made. Accordingly, a couple of years have been devoted to research work on this apparatus; and now we shall very shortly be in a position to put on the market a type of stove that is going to reduce greatly the fuel bill in your houses. New principles and new ideas have been devised and embodied in it; and many of these are the subject of patents. In the designing of this stove, and in the preparation of plant for its production, many thousands of pounds have been expended. Naturally, the details connected with the design and construction of an apparatus like this—which embodies the experience of a number of men who have spent their lives in our industry, and, associated with them, some of the most able chemists engaged in the industry—have to be guarded most carefully for the present, so that these should not become prematurely known. Therefore, while we have been requested by many of our friends to let them into our secrets, yet, much as we should like to do so, you will recognize that it would not be the right course until we are really putting this stove on the market, so that we may reap the benefit and enjoy the credit to which we are entitled for the work we have done and the enormous expenditure in which it has involved us. I may, however, mention that, notwithstanding the fact that gas is not likely to become as cheap as it formerly was, you will be able, with this new cooker, to cook at as low an actual cost for gas as before the war.

THE DIVIDEND.

I expressed at the outset the view that we are fortunate—after such a difficult year as 1921 has been for so many concerns—to find ourselves able to show results so satisfactory. This is the more gratifying when I tell you, what you will doubtless be interested to hear, that we do not get 5 p.ct. profit on the very large combined turnover of the various businesses of this Company. Your Directors are glad to feel themselves in a position, notwithstanding that the profits for the past year are somewhat less than those of the previous year, to recommend a final dividend on the ordinary shares, which, with the interim dividend already paid, makes 6 p.ct. for the year, free of tax as in previous years. Owing to the number of the various concerns that are associated with Radiation, it has been found extremely difficult to complete all the necessary figures to enable us to hold our annual meeting at this date. It has entailed a very severe strain not only upon the officials of the various concerns, but also upon the auditors of the Company; and we are therefore proposing to have our annual meeting next year about the third week in March, when the dividend warrants will be sent out.

Mr. H. M. Thornton seconded the adoption of the report, which was carried unanimously.

HASTINGS AND ST. LEONARDS GAS COMPANY.

The report for the half year ended Dec. 31 submitted by the Directors at the recent meeting, stated that the sale of gas showed an increase of 3½ p.ct. as compared with the corresponding period of the previous year. There was an increase in the number of consumers, largely due to the sub-division of property; and this led to the use of a great many more meters than were formerly required. The price of gas during the year was 6s. 3d. per 1000 c.ft., equal to 16·3d. per therm. The value of the gas, as declared on Dec. 28, was 460 B.Th.U. As from the Christmas readings of the meters, the price of gas was reduced to 1s. 2d. per therm, equivalent to 5s. 4·4d. per 1000 c.ft. The Directors recommended final dividends making, with the amounts paid for the first half of the year, the dividends authorized under the sliding-scale —£5 3s. 9d. p.ct. per annum on the 5 p.ct. converted stock, £3 14s. 9d. p.ct. per annum on the 3½ p.ct. converted stock, and £5 2s. 7d. p.ct. per annum on the 5 p.ct. additional stock.

The Chairman (Dr. G. G. Gray, J.P.) ventured to think they were now emerging from the long, dark, dreary road, beset with various difficulties, through which they had been struggling during the last seven years, and had come at last into the open and the light, from which they might expect once again to see the sun of prosperity arise. He felt certainly much happier in the chair that day than he had done during those long years. In spite of the decreased value of residual products, there had been a net increase of £5632 in the turnover on revenue account. No one could conceive the pleasure it gave him to move the payment of the dividend stated in the report—especially having regard to the great injustice which they, together with gas undertakings generally, had sustained. Appreciation was expressed by him of the efforts of Mr. C. F. Botley (the Engineer and General Manager) during the very trying period through which they had passed.

The report was adopted.

Commercial Gas Company's Further Reduction.—The Directors of the Commercial Gas Company have decided to make a further reduction in the price of gas of 1d. per therm. This reduction, with that made as from Christmas last, equals 3d. per therm, which is equivalent to 1s. 2½d. per 1000 c.ft., and means a saving to the consumers of, approximately, £213,000 a year. The new price will be 1s. per therm, or 4s. 9d. per 1000 c.ft.

Price of Gas at Warwick.—The price of gas charged in the borough was the subject of a discussion at a recent meeting of the Warwick Chamber of Trade, when it was reported that, having regard to the fact that the price of coal and labour had been reduced, and that other gas companies have lowered the price of gas, the Committee of the Chamber approached the Warwick Gas Company, with a suggestion that they should re-consider the matter. The Company, however, pointed out that the increase had only been in operation for one quarter, while other gas companies had charged higher prices for some time. It was stated that the Committee were satisfied that no further action should be taken at present, but that the subject would be kept before them for attention when the proper time arrived.

ISLE OF THANET GAS COMPANY.

The Annual Meeting of the Company, who are responsible for the gas supply of Margate, was presided over by Mr. Walter Hills (the Chairman), who said the Directors could quite understand the satisfaction with which the proprietors received the information contained in the report. Every difficulty with which they had been confronted during the past year was resolutely faced and overcome by the undaunted energy and inflexible determination of the management, of whom it was impossible to speak too highly. Of all the many lessons which recent experiences had taught them, none stood out so prominently as the necessity for restoring confidence and promoting a wider extension of the plan of industrial co-operation between employers and employed; and there could be no shadow of doubt that, until these essentials were secured, there could be no permanent industrial peace. In particular, it would be folly to disregard the serious conditions still prevailing in the coal-mining industry, with its mistaken and aggressive policy of over a million misguided workers. During last year, 83 million working days were lost in trade disputes, 70 million of which were lost in the dispute in the coal industry. There was, however, another side of the picture, which was, though still sombre, a little brighter; and in fairness they should thankfully recognize the gradual and very hopeful improvement that was occurring in the relations between masters and men, conclusively evidenced by the fact that over 2000 firms, involving 7 million workers, had entered into amicable and satisfactory agreements with their employees as to future remuneration and working conditions, with the remarkable result that during last year wages were reduced by no less than £6,000,000 a week, and the wages paid to the miners by £2,500,000 a week. The view of the Directors was that everything possible should be done to improve the environment of their workers; and their intention was to perform their part in this direction. They had, in fact, with no slight success, endeavoured to promote and foster a spirit of contentment among the staff and employees. The Woodall-Duckham vertical retorts had given thoroughly satisfactory results; and to-day the Company were making approximately 14,000 c.ft. of gas per ton of coal carbonized. But the Directors, being convinced that much better results were possible, and relying upon the advice of their Engineer and Manager (Mr. J. M Campbell), had decided to make certain alterations and improvements, by which it was hoped the make of gas would be increased at least 3000 to 4000 c.ft. per ton. In addition to this, a new holder was in course of construction. The profit on the year's trading was less than the previous year by about £1150; but with the amount brought forward they were able to allow for a final dividend of 4½ p.ct. being paid (making 5½ p.ct. for the year), and yet leave practically £2000 to be carried forward. Referring to the alleged dangers of gas, he said they were indebted to Mr. D. Milne Watson, the Governor of the Gas Light and Coke Company, and President of the National Gas Council, for figures which supplied an overwhelming answer. The industry was also very much indebted to the Editor of the "Gas Journal," who had been fearless, with others, in the defence of the industry in this and many other important matters. The price of gas was 13·2d. per therm; and this would enable them to pay next year the pre-war dividend of 6½ p.ct., assuming that they were able to earn it. In conclusion, he remarked that the Directors highly appreciated the honour reflected upon the Company by the election of Mr. Campbell as President of the Southern Association of Gas Engineers and Managers.

The report was adopted, and the remuneration of the Directors was increased from 700 guineas (free of tax) to 1000 guineas (free of tax).

NOTTINGHAM GAS SUPPLY.

Following upon long-continued complaints in the columns of local newspapers regarding the alleged indifferent quality of the gas supply, insistent demands were made at a meeting of the Nottingham Corporation last week for a reduction in prices; the debate culminating in the reference of the matter to a Committee.

Incidentally, comparisons with regard to relative prices were drawn between Nottingham and the neighbouring town of Derby, to the great advantage of the latter; but while Mr. H. Gover Ford (Vice-Chairman of the Committee), who undertook the reply on the discussion, was fain to admit that private companies such as that at Derby "did manage by some means to work upon more economical lines," he cited significant instances of large centres in which the prices charged are considerably higher than those in Nottingham, whose current rate is 4s. 6d. per 1000 c.ft. The price in Nottingham before the war was 2s. 4d. At the conclusion of the coal strike last year, he added, the Gas Committee found that their coal supplies had dwindled to about 2000 tons; and to ensure against further experiences of the kind, they had to enter into contracts at a high price. There were still 7000 tons due to come under these contracts at prices round about 31s. a ton, though some gas coal was now being obtained as low as 18s. The cost of other materials had risen enormously, as was illustrated by the fact that firebricks had gone up from £4 2s. 6d. to £11 per 1000; and silica bricks, from £5 5s. to £14 14s.

To a resolution proposed by Mr. T. Parks, in favour of a reduction in price, and instructing the Committee to report upon the question at the next meeting, an amendment submitted by Alderman E. Huntsman was adopted, directing the Committee in general terms to go into all the details, and to present a report; the amendment not binding the Committee to any particular date for the presentation of their decision, but it being understood that the report might be available at a period subsequent to that at which the next annual financial statement of the Committee will be dealt with by the Council. The mover of the amendment, who is the leader of the Liberal minority in the Council, expressed his agreement that the time had arrived for a proper inquiry into the matter; and this view appears to be shared generally by gas consumers in the city and outlying districts.

BRIGHTON GAS COMPANY AS EXHIBITORS.

The most conspicuous and elaborate feature of the Brighton and Hove Grocers, Bakers, Confectioners, and Caterers' Exhibition, now being held in the Dome, is the stand of the Brighton and Hove Gas Company, replete with examples of the great benefits which gas confers upon the community. In the fitting-up of the stand, assistance was rendered by the following firms: Messrs. Arden Hill & Co., Birmingham, trade appliances, hot water apparatus. The British Commercial Gas Association, gas bye-products. Messrs. Crossley Bros., Ltd., Manchester, gas-engine. The Davis Gas-Stove Company, Ltd., Luton, garage heater. Messrs. Fletcher, Russell, & Co., Ltd., Warrington, trade and domestic appliances. The Gas-Meter Company, Ltd., London, demonstration meter. Messrs. Jackson Boilers, Ltd., Leeds, counter fount. The South Metropolitan Gas Company, gas bye-products. Messrs. W. Sugg & Co., Ltd., London, lighting appliances. The Thermal Syndicate, Ltd., Wallsend-on-Tyne, demonstration set showing the resistant nature of silica ware.

The stand itself is devoted to appliances specially catering for the trades from which the exhibition takes its name, and the Company are showing in this connection a gas-fired sugar-boiler, large grilling apparatus, pastry oven, double cooking oven, fish-fryer, gas-engine, cake-plates, &c., and a counter fount, in operation, furnishing boiling water for restaurant use. They also show the various types of gas-fires, cookers, and plate-racks which are offered on simple hire terms to customers; while there is a working exhibit on the stall of hot water furnished by a boiler and cylinder complete, demonstrating the functions of the thermostat in the automatic control of the gas consumption. There is also a working exhibit of the properties of the new "Silica" ware, demonstrating its resistant nature by dripping cold water on to the globe while incandescent. The home clothes washer, dryer, airer, and a display of bye-products, a safety garage radiator, geyser, wash-boiler, &c., complete the exhibits on the floor space. The lighting of the stall is by Messrs. Sugg's "Bon Marché" semi-indirect fittings; and in addition there is shown the safety garage back lamp and pendant.

Passing through the stall the visitors approach a beautifully fitted "all-gas" bungalow, by way of a daintily laid out garden, replete with flower beds, grass lawn, and little rockery pool with water lilies. The front of the bungalow is covered with climbing clematis and ramblers, as also are the garden fences. The garden is lighted by Sugg's "Surbiton" lamps, fixed on the back of the pillars of the stand. Entering the bungalow, one passes into the hall, where there is an antique lantern, switch-controlled, radiator for warming, and a cigar lighter. The drawing room leads out of the hall, in which the Company again demonstrate the switch lighting of the shade light centre pendant, while the brackets are operated by the ordinary tap. The heating in this room is effected by an "Aero" fire.

The bedroom comes next; and here the lighting is by a pendant over the dressing-table and a bracket over the bed, both switch-controlled. The heating is effected with a "Talisman" fire, with side boiling burner; while on the mantelshelf there is a curling-tong set for the use of the ladies.

In the bathroom hot water is furnished from the circulator in the kitchen, both to the lavatory basin and the bath; while additionally a "Pearl" geyser furnishes hot water at the lavatory basin for shaving, and a "New Teba" geyser is at the bath for water heating, as an alternative method to the circulator. The kitchen is fitted with a "Hot Flow" boiler for the sink, which demonstrates the separate apparatus for dish-and-plate washing; while again the sink is connected-up to the circulator which forms part of the "all gas" kitchen, comprising a small gas cooker, fire, and circulator of the "Potterton" type. The circulator is connected to a 20-gallon hot tank in the roof, and is fitted with a control valve enabling 10 gallons to be cut-out. To complete the kitchen, there are a gas-iron and coffee-roaster.

In the dining room, the last of the six rooms of the bungalow, is a "Sunbeam" fire in the grate, in armour bright finish, fitted in an inglenook recess fireplace; while the lighting is effected by a shade light over the dining-table. The entrances to the Company's stall are illuminated by two 12-light "Littleton" lamps, so that there is no mistaking the way in.

The Engineer and General Manager of the Company (Mr. Charles H. Rutter) and the Distributing Engineer (Mr. Percy E. Browne) are to be congratulated upon the striking display thus made by gas.

PRICE OF GAS IN BIRMINGHAM.

A Further Reduction.

The Birmingham Corporation Gas Committee, reporting to last week's meeting of the City Council, said it was very gratifying to them to be able, so soon after their last report, to recommend a further reduction in the price of gas. The lower wages and salaries, and further reductions in the price of coal which had been secured for forward deliveries, warranted them in recommending that the scale of charges approved by the Council in January last be further decreased by 6d. per 1000 c.ft. all round, as from the March readings of the meters.

Alderman LLOYD, moving the adoption of this revised scale of gas charges, said he understood there was criticism in some quarters of the proposal to make a flat reduction of 6d.; and the view had been expressed that a larger reduction should be given to the small user than to manufacturers, who received special consideration on the occasion of the last reduction. It must not be forgotten that from 1915 onwards the large consumers had been subjected to greater increases in the price of gas than the small consumers. Even with the reduced price proposed, the manufacturer and large user would still be paying a higher percentage advance on the cost of gas than small consumers. With the reduction of 6d. all round the smaller user would only be paying an advance of 125 p.ct. upon the scale adopted early in 1915, whereas the largest consumers for manufacture and motive power would be paying 156·25 p.ct., or over 25 p.ct.

Alderman P. BOWER moved an amendment that the following should be added to the resolution: "And the Gas Committee be requested to consider and report upon the possibility of (*a*) narrowing the present margin between the prices charged to the large and small consumers, and (*b*) charging the same price for each parcel of gas consumed, irrespective of the purpose the consumer may use it for."

Alderman STEVENS seconded the amendment. He said he considered the charges for gas unfair and unbusinesslike. The Gas Committee had not computed the charges in a businesslike way; and he thought they had been based on mere guesswork. What he wanted, and what he had asked for, was the cost of production and distribution; and if such figures were available, the Council would be able to judge whether the different charges were equitable to the consumers. He considered the small consumers were bearing the burden for the large consumers. The Committee in charging 3s. per 1000 c.ft. to the larger consumers were selling at a loss; or, if not, then the Committee were making a tremendous profit on the 4s. 6d. charged to small consumers.

Alderman LLOYD said he was prepared to accept the amendment proposed by Alderman Bower, so that the Committee might, if possible, give a considered report which might help to satisfy all reasonable people in regard to the matter. The figures asked for by Alderman Stevens would be available to him, as to any other member of the Council, as soon as they were prepared. It was perfectly impossible to say from day to day, or week to week, what the cost of gas was. The Accountant had handed him figures relating to accounts and office expenses; and it was interesting to note that a manufacturer taking 10 millions a quarter in one building cost the department 12s. 4d. per annum. It would take 1000 householders, each consuming 10,000 c.ft. per quarter, to equal this consumption; and the charge for the same service would amount to £504 2s. 4d. per annum.

The report of the Committee was approved.

CHELTENHAM GAS COMPANY.

The annual meeting of the Company was held at the offices last Wednesday week—Mr. ROWLAND TICEHURST (the Chairman) presiding. There was a much larger attendance of shareholders than usual, in anticipation of a contest over the directorate. The retiring Directors were, however, re-elected on a poll.

The CHAIRMAN, in moving the adoption of the report, remarked that the operations for the year, after providing for interest on debenture stock, had resulted in a surplus of £20,140, compared with a deficiency of £5821 for the year 1920; so that the Company had made a good recovery during the twelve months. The actual reduction in expenditure in wages, salaries, &c., was £3489. The gas consumed for private lighting showed an increase of over 15 million cubic feet; and it was hoped that, with the reduction recently made in the price of gas, the consumption would continue to increase. With regard to residual products, the sales of coke showed a satisfactory increase of nearly £7500; but there had been a decline in the sale of tar by a somewhat similar amount. The sulphate of ammonia sales had been disappointing, being less by nearly £2500. This was due to a general falling in values of artificial manures throughout the world. A reduction in receipts from residuals was the common experience of gas companies. The total income showed an increase of £22,600; and the expenditure was less by a little over £3000. The Directors recommended the payment of the full statutory dividend at the rate of 5 p.ct. per annum for the half year ended Dec. 31, 1920. At present they were not prepared to recommend any payment on account of the dividends for the year 1921. There was, however, every prospect that during the coming year they would be in a position to make a payment on account of those arrears. With this object in view, the Directors proposed to ask the shareholders to give them authority to make such further payment if they thought it advisable.

Mr. LEWIS VIZARD seconded the motion, which was carried, as was the corollary resolution declaring the dividend.

The CHAIRMAN next proposed a resolution authorizing the Directors to declare a dividend for 1921 out of the profits of the ensuing year or out of the reserve fund.

Mr. PRUEN doubted the wisdom of resorting to the reserve fund for revenue purposes.

Mr. WILLIAMS, however, pointed out that the reserve fund was built-up out of profits; and seeing that the Company's dividends were limited by Statute, he contended that the Directors were justified in using the reserve fund for the equalizing of dividends.

The CHAIRMAN added that the only way the reserve fund could be used was in the payment of dividends.

The motion was agreed to.

A long discussion then took place on the motion for the re-election of the retiring Directors.

Mr. W. S. MORLAND (the Engineer of the Gloucester Gas-Works), in the course of this discussion, threw light on the difficulties which the Cheltenham Company, in common with all other gas companies, had had to contend against during the war period, which difficulties were more than sufficient to account for the position of the concern last year, when the shareholders went without a dividend. It was not true to say that the works were out of date. Up to the last four months, Gloucester was using exactly the same kind of machinery as Cheltenham. But the Gloucester Company were in a position to charge up to 5s. per 1000 c.ft., while Cheltenham's maximum charge was 4s.; and this accounted for the loss on trading in 1920. There was nothing wrong with the management. Now that the maximum price had been raised, the Company could pay their way; and he was convinced that, with the cost of labour decreasing and coal coming down, they would see the undertaking more prosperous than ever in the future.

The St. Ives Gas Committee are considering reducing the price of gas next quarter, said Mr. T. R. G. Grant (the Manager), at a Board of Trade inquiry into the Council's application to borrow £830 for renewing and extending mains. The application was not opposed.

ALDERSHOT GAS AND LIGHTING COMPANY.

Addressing the proprietors at the annual meeting of the Aldershot Gas, Water, and District Lighting Company, Mr. R. W. Edwards (the Chairman and Managing-Director) said the year 1921 would stand by itself as a period of the severest trial. The Company had not been so fully prepared for the coal strike last April as was their custom, because, following so closely on the strike of the autumn of 1920, there was a feeling that anything in the way of an immediate interruption of work in the mines would be of a somewhat temporary nature. It was, unfortunately, not so; and on the top of the serious handicaps left by the war—and particularly since the autumn of 1917—they had to face making extraordinary arrangements for carrying on, at a cost which far outpaced the value received for their commodities. It was the determination of the Directors that the supply should not be interrupted or curtailed, and that the quality and pressure of the gas should be maintained. Coal was therefore purchased from various parts of the world, at tremendously high prices; and this was not the end, because the quality left much to be desired. He had had accurate figures taken out from the operating costs, as to the extra sums incurred during the three months of the coal strike; and he found that, without taking into consideration the loss of business due to restrictions imposed by the Government on the use of gas, and to other collateral effects, the cost of the strike represented to the Company about £14,000. The accounts showed that the loss in revenue from residuals represented over £13,000; and yet, taking into consideration all circumstances, the drop in profit in the gas undertaking had been only £11,764. With the advent of their Order under the Gas Regulation Act, on April 1, the Company declared the quality of the gas at 450 B.Th.U., and later, from July 1, increased this to 500 B.Th.U.; the idea being to maintain a high quality of gas. He did not wish it to be thought that they regarded this standard as the omega—on the contrary, gas manufacturers must of necessity apply themselves to ascertaining the most suitable quality to be maintained according to local circumstances, together with the raw material and plant available for carbonization. The Directors would consider at an early date a further alteration in the quality of the gas, of which due notice would be given. So far, they were satisfied that the public appreciated what had been done. The great drawback to-day was price. Undoubtedly it was too high; and as soon as possible they would continue to bring it down. It was reduced, on July 1, by 0·4d. per therm, and again at Christmas last, by 0·6d. per therm—in all, 1d. per therm, representing a saving of nearly £9000 a year to the public. From next midsummer, they had intimated a further drop in the "B" area of 0·6d. per therm. The Board were determined (as before the war, when the Company's reputation stood high as manufacturers of some of the cheapest gas in the country), as circumstances permitted, to get down to something approaching pre-war level. The outlook was undoubtedly promising; and the Directors had different schemes on foot for the enlargement of their business.

The Chairman having dealt with the other branches of the Company's operations, the report was adopted, and dividends at the full statutory rates were declared.

TRADE NOTES.

The "Sydenham" Grate.

The "Sydenham" grate continues to make headway, and is now in operation at, or on order for, many gas undertakings in various parts of the country. The absence of formation of clinker, low maintenance costs (no false bars are required), increased production of coke for sale, and the maintaining of regular heats, are some of the important advantages derived by its adoption, which are being increasingly appreciated by its users. Recently orders have been received for Deal (repeat), Harpenden (repeat), Croydon, Canterbury, and Hoddesdon. The incorporation of the "Sydenham" grate in the "Simplex" water-gas plant has proved a great success; and this grate now forms part of the standard design of the plant. The increased efficiency of the plant resulting from the absence of clinker will be readily appreciated by engineers. "Simplex" plants (with "Sydenham" grates) have recently been ordered for Atherstone (twin), Launceston, Palmerston North (N.Z.). Huntingdon, Swanage (twin), and Hoddesdon.

Ogley Hay Gas Company's Order.—The Brownhills Council have decided to oppose the application of the Ogley Hay Gas Company for permission to charge 1s. 9d. per therm for their gas, instead of 5s. 6d. per 1000 c.ft. Mr. J. Blakemore said the proposed charge would mean an increase in the price from 5s. 6d. to 8s. 1d. per 1000 c.ft. He moved that the Council protest against the application of the Company, and recommended consumers to hold protest meetings. Mr. E. J. Mason seconded, and said it was questionable whether the Company would get 1s. 4d. Mr. Jarvis understood the Cannock Chase Colliery Company were laying an electric cable in the locality, and were prepared to light the lamps at £3 per annum each. It was decided to write to this Company.

Cork Gas Consumers' Company.—The report submitted at the meeting of the Company stated that there had been a satisfactory increase in the quantity of gas sold during the past half year; but, owing to the reduction in the price of gas and residuals, the receipts from these sources were considerably less than in the corresponding period of 1920. The balance of profit and loss was £3070; and the proposed dividend was at the rate of 6 p ct. per annum. Mr. W. B. Harrington (the Chairman) said the results of the working might be regarded as, on the whole, gratifying. The reduction of 6d. per 1000 c.ft. in the price of gas meant a loss of £8000 a year. On the other hand, this reduction, and the greatly extended use of cooking and heating stoves, had produced an increased consumption. They hoped, with the better conditions prevailing, and when they had been granted their Order, that they would be able to make a further reduction.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 13.

The London tar products market remains quite steady, although there is not much new business to report. Makers of pitch are in a very comfortable position so far as sales are concerned, and quantities are being shipped as fast as boats are available. Stocks of pitch in the whole country are materially below normal; and as the Continent is still a buyer, it is no wonder that for some weeks the value has steadily advanced. The present price is 75s. to 80s. net per ton f.o.b. at makers' works. Creosote continues unchanged; and the figure is about 6¼d. to 6½d. net per gallon in bulk at makers' works, according to quantity. There is nothing fresh to report as to other tar products.

With respect to sulphate of ammonia, it is stated there are inquiries on the market for very large quantities for export, in consequence of the world-wide shortage of this material, and, of course, as a result there is a general increase in price.

Tar Products in the Provinces.

March 13.

The average values for gas-works products during last week were: Gas-works coal tar, 36s. to 41s. Pitch, East Coast, 75s. to 77s. 6d. f.o.b. West Coast—Manchester, 70s. to 72s. 6d.; Liverpool, 70s. to 72s. 6d.; Clyde, 72s. 6d. to 75s. Benzole 90 p.ct. North, 2s. 1d. to 2s. 2d.; crude 65 p.ct. at 120° C., 1s. 5d. to 1s. 7d. naked at makers' works; 50-90 p.ct., naked, North, 2s. 1d. to 2s. 2d. Toluole, naked, North, 2s. 2d. to 2s. 5d. nominal. Coal tar crude naphtha in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 2s. 2d. to 2s. 4d. Heavy naphtha, North, 2s. 1d. to 2s. 3d. Creosote, in bulk, North, liquid, 4¼d. to 4⅜d.; salty, 4¼d. to 4⅜d. Scotland, 4¼d. to 4⅜d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct., 1s. 10d. to 2s. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. to 6d. per minimum 40 p.ct.; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

There is practically very little improvement in the position with regard to tar products generally. Buyers are holding off, and trade is quiet. It is noted that from the coke-ovens the quantity of tar available for distillers is slightly increasing; but with the approach of summer the amount from the gas industry will be less, and the position with regard to tar is thus somewhat difficult to forecast. Pitch has remained a strong market, and up to 85s. per ton has been quoted in London; but whether business has actually resulted at these prices it is not possible to state. The Continent is a strong buyer if inquiries recently to hand are any guide. The outlook is uncertain, and in some quarters it is thought a mistake for prices to be forced higher than they are now. At the same time the road-making demand is coming on, and the total output of pitch is comparatively small. Solvent naphtha is only in small request, as the rubber works are not yet busy again. Prices remain from 2s. 6d. to 2s. 8d. per gallon. Naphthalene is dull, with refined at £16 10s. and crude £5 to £6 per ton. Creosote is uncertain, with prices ranging from 5d. to 5½d. per gallon. The position in carbolic acid is unchanged. Very little business is being done, as makers of crystals do not find a sufficient outlet for their product, even at 5½d. per lb., and consequently will not pay more than about 1s. 4d. per gallon for crude. The market in intermediate products has been rather more interesting, both on home and foreign account. There is no change to report in any of the prices.

Sulphate of Ammonia.

Orders now coming forward for sulphate of ammonia are of good dimensions, and the trade would be in a position to congratulate itself on such business were it not for the fact that outputs are considerably restricted and much below requirements. The general shortage is not confined to this country alone. Consequently, prices abroad are higher than would otherwise have been the case. If the foreign demand is to be met by producers in this country, then the outlook for the farmer here is not very promising, since reports from various distributing centres indicate that the majority of agriculturists have held off buying in the hope that prices would fall. Such an event is now a practical impossibility. The current prices which remain in force until the end of May are: For neutral quality 25⅜ p.ct. ammonia, £17 3s., and for ordinary quality 25¼ p.ct. £16; 4-ton lots and upwards to the nearest station, packed in 2 cwt. bags. From America comes the news that there has been quite a scramble on the part of domestic consumers to fulfil their requirements. The export demand has continued without interruption, and it is reported that Great Britain has been purchasing in the American market.

Employment at the Accrington Gas-Works.—Alderman Dewhurst, in the Accrington Town Council last week, referred to the discharge of men at the local gas-works. He said that several years ago—even prior to the war—the Gas Board decided to dismantle the Accrington Gas-Works, as the cost of production there was uneconomical—the site being unsuitable, and too restricted for modern extensions. The war, however, intervened; and as the Government declined to permit extensions at Great Harwood, the Accrington works were kept going up to a recent date. The new generator at Great Harwood had now been got to work; and consequently the men at the Accrington works could be dispensed with. The Board, out of sympathy, had retained a considerable number for many months longer than was absolutely necessary. Many of the older men would be absorbed as vacancies arose at other works of the Board.

BISHOP'S STORTFORD, HARLOW, AND EPPING GAS AND ELECTRICITY COMPANY.

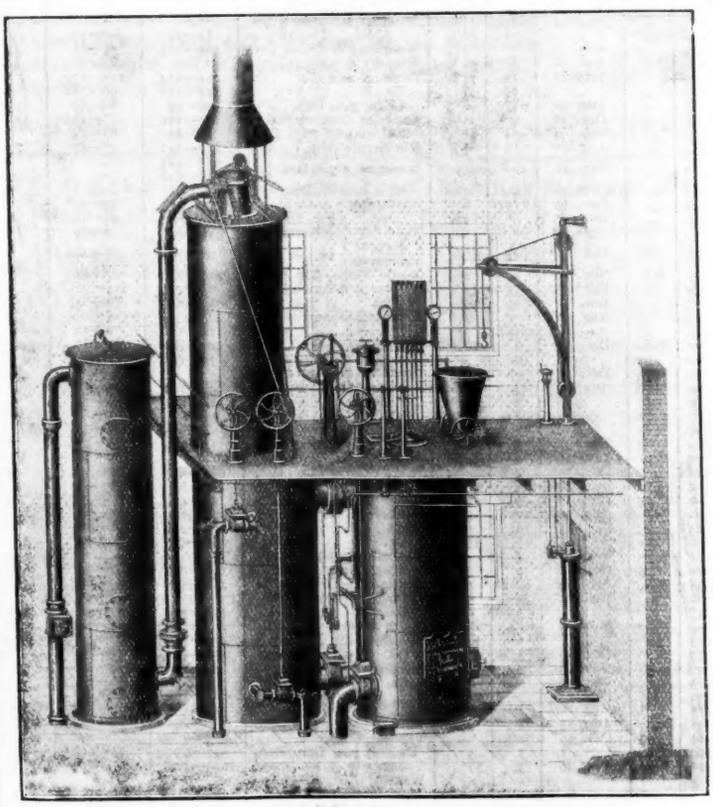
Presenting the accounts for the year 1921, the Directors reported that, as a result of the Company's application to the Board of Trade for the issue of an Order under section 1 of the Gas Regulation Act, 1920, the Bishop's Stortford, Harlow, and Epping Gas (Charges) Order, was made on June 27, 1921. This Order prescribes a new standard price for the gas supplied by the Company of 1s. 8d. per therm in substitution for the standard price of 4s. per 1000 c.ft. prescribed by their Act of 1910. The Directors gave notice that, as from June 29, the declared calorific value of the gas the Company intended to supply was 500 B.Th.U. Gas was supplied by the therm as from June 29, the charge per therm being 1s. 4d.—virtually a reduction of 2d. per therm, and (having regard to the improved quality of the gas supplied) equivalent to 10d. per 1000 c.ft. During the entire period of the coal strike, the Company were able to maintain a continuous supply of gas to all consumers. This necessitated the purchase of supplies of foreign and other emergency coal at most exorbitant prices; much of the coal being totally unsuitable for the production of gas or coke. Owing to its excessive cost and the deficient results obtained, the Company sustained a loss estimated at £1316. The sales of gas, compared with those for the preceding year, were less by 7,860,900 c.ft., or 5·5 p.ct. The sales of electric current amounted to 23,325 units—an increase of 10,975 units, or 88·8 p.ct., over those during the preceding year. The balance carried to the credit of profit and loss account was £7557; the total sum available being £5855 The Directors recommended dividends at rates making the distribution for the year £5 14s. p ct. upon the "A" stock and £5 10s. upon the "B" stock, thus reverting to the rates paid prior to the war. On the application of the Directors, the Board of Trade made an Order under section 10 of the Gas Regulation Act which (*inter alia*) substitutes an annual ordinary general meeting for the half-yearly ordinary general meetings hitherto held, and empowers the Directors to declare interim dividends.

ROA ISLAND (BARROW) GAS SUPPLY.

Reference was made at the Barrow Town Council meeting last week to the gas supply to the residents of Roa Island, which is five miles from the Barrow Corporation's central gas-works. For 56 years the Furness Railway have made gas at Roa Island, and supplied, besides householders, some of the lighthouses marking the dangerous places at the entrance to Piel Channel. Recently the system of the port lighting has been altered; and the works have been used simply to manufacture gas for supplying neighbouring houses, the railway station, &c. The Furness Railway have been losing money on this small undertaking; and they gave notice to the inhabitants of their intention to cease the supply last year. They have, however, carried on, until now there is a definite decision to stop and cut the loss as from March 31 A deputation of residents from Roa Island interviewed the Barrow Corporation Gas Committee, and asked that steps should be taken to ensure them a continued gas supply, at least until such time as the Corporation Electricity Committee could run a cable to supply the requirements of the residents for lighting and cooking. The Gas Committee informed the deputation that they could not see their way to take any action in the matter. At the Town Council meeting, an amendment was moved that the Committee give further consideration to the matter, though Alderman Brown stated that the gas plant at Roa Island was antiquated, and could not be taken over. To lay gas-mains from the Corporation's Salthouse Works to Roa Island would cost £7000; and to pay 10 p.ct. per annum to meet interest on loan, redemption, and maintenance, would mean £700 a year, against an estimated income for gas consumed of £130 to £150. The Council decided that the Gas Committee should reconsider the matter.

Thames Conservancy Board and the Uxbridge Gas Order.—At last week's meeting of the Thames Conservancy Board, the Parliamentary Committee reported that they had refrained from taking any action with regard to the Order being promoted by the Uxbridge, Wycombe, and District Gas Company for transferring to the Company the undertaking of the Great Marlow Gas Company, and for extending the area of supply of the joint undertaking. The Conservators, interests were protected by certain provisions of the Order which expressly preserved the existing saving section in the Great Marlow Gas Order, 1898, prohibiting any interference with the bed and banks of the Thames or its navigation, without the Conservators' consent. The Board approved the Committee's action.

Richmond (Surrey) Gas Company.—Submitting the report and balance-sheet at the half-yearly meeting of the Company, the Chairman (Mr. H. Pullman) pointed out that the net profit for the six months was £5130; and after the payment of a dividend at the rate of 4¾ p.ct. per annum, there would remain (together with the undivided profits brought from the previous half year) a total of £4422 to carry forward. The dividend mentioned was the maximum permitted. Notwithstanding the abnormal weather conditions in the summer and autumn, there had again been an increase in the consumption of gas. The Company had got their Order under the Gas Regulation Act; and the Directors thought the terms obtained were sufficiently good for the proprietors to be congratulated. Since the previous meeting, a carburetted water-gas plant which had been installed at the works had been put into operation; and this would make for economy. He did not think the optimism which he had expressed at previous meetings had been misplaced; and already a return to prosperity was to be seen in the balance-sheet before them. To the success now to be recorded, the untiring energy and skill of the Engineer (Mr. E. G. Hutchinson) and the loyal co-operation of the Acting Secretary (Mr. J. Gooderham), and, in fact, the efficient working of the whole of the staff, had largely contributed; and they were one and all entitled to thanks.



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Cheaper Gas at Brentford.—The Brentford Gas Company announce a reduction in the price of gas of three-fifths of a penny per therm, representing about 2¼d. per 1000 c.ft., after the taking of the meter indices for the Lady Day quarter. This is in addition to a decrease of 1d. per therm as from Jan. 1 last.

Opposition Withdrawn at East Grinstead.—It has been decided by the East Grinstead Urban District Council to withdraw their opposition to the East Grinstead Gas and Water Company's application for an Order to vary the price of gas. The Council and the Company have reached an agreement; the maximum charge to be 18·8d. per therm in the Company's inner area and 21·2d. in the outer area. Mr. Jenks (Chairman of the Gas and Water Committee) said the arrangement was a satisfactory one; the agreed price being 2d. less than the 20·8d. per therm asked for by the Company. He acknowledged the amicable manner in which the Council had been met by the Company, and trusted their relations would always remain friendly.

Gas Cookery Competitions.—At the Bakers' and Allied Trades' Exhibition at Glasgow this month, there will be a series of competitions promoted by the Glasgow Corporation Gas Department in connection with gas cookery.

West Bromwich Gas Undertaking.—The Town Council of West Bromwich met last Wednesday week, when a lengthy report was presented by the Gas Committee. The report stated that the Committee had for some time past had under consideration the condition of the vertical retorts, and the work necessary for the repair or re-construction and modernizing of the installation. The Committee recommended that the tender of Messrs. Woodall Duckham be accepted for the work. Alderman Cox (the Chairman of the Committee) said when the repairs were completed they would be able not only to produce a greater quantity of gas, but also to accumulate a very much larger revenue than at the present time. The cost would be between £10,000 and £11,000. The recommendation of the Committee was approved.

STOCK MARKET REPORT.

BUSINESS in the Gas Market last week showed increased activity. All three London Companies made further advances. Brentford "A" and "B," Brighton and Hove "A," Lea Bridge, the three Sheffields, and Southampton gained 2 each, and South Suburban and Tottenham "A" and "B" 1 each; while all the rest were very firm, though unchanged. Imperial Continental continued to rise, and changed hands at the top price of 152. In Primitivas the ordinary rose from 14s. to 21s, and the preference from 46s. 3d. to 61s. 3d.

Bargains done for cash during the week were as follows: On Monday, Brentford "B" 85, Brighton and Hove original 148, ditto ordinary 95½, Commercial 4 p.c.t. 79, ditto 3½ p.c.t. 78, 79, Continental Union 18, European 8⅞, 8⅞, 9, 9⅛, Gas Light ordinary 79, 79¼, 79½, 80, 80¼, ditto maximum 59½, ditto preference 69, 69⅜, 70, ditto debenture 55, 55½, Imperial Continental 148, 148¼, 148½, 148⅝, 149, 149½, 150, Oriental 85½, 85¾, Primitiva 14s. 6d., ditto preference 46s. 3d., 50s., South Metropolitan 82½, 82⅜, 83, 83⅛, South Suburban 90, Tottenham "B" 81, 82, Brentford 6 p.c.t. debenture 95, Hornsey 5 p.c.t. preference 80, Liverpool 7 p.c.t. preference £30 paid 34½, 34⅞. On Tuesday, Bombay 3⅜, 3¾, Brentford "A" 85, ditto "B" 84½, ditto debenture 70, Brighton and Hove original 150, ditto ordinary 99½, British 27⅞, 28, Commercial 4 p.c.t. 78½, 79, Continental Union 20, European 8 13/16, 9 1/16, 9¼, Gas Light ordinary 78½, 78¾, 79, 79¼, 79½, 79⅝, 80, ditto maximum 58½, 58⅔, Imperial Continental 149, 150, 150½, 151, 151⅛, 152, Lea Bridge 79, 80, Primitiva 14s., ditto preference 47s. 6d., 49s., 49s. 6d., 50s., South Metropolitan 82⅜, 83, 83 1/16, 83⅛, 83½, ditto 6½ p.c.t. debenture 105. South Suburban 88½, 89, 90, Southampton 59, Liverpool 7 p.c.t. preference £30 paid 34, 34½, Southgate 7 p.c.t. maximum 84, Pinner 7 p.c.t. "B" 4⅜, Wandsworth 4 p.c.t. debenture 70. On Wednesday, Brentford "A" 86, Brighton and Hove original 149, 150, British 27⅛, 27⅜, 28, Commercial 4 p.c.t. 79½, 80⅛, 80⅜, Gas Light ordinary 78½, 78¾, 79, 79¼, 79½, 80, Imperial Continental 149, 150, 150¼, 150⅜, Newcastle debenture 64⅜, Primitiva 15s. 3d., 16s., 16s. 6d., 16s. 9d., 17s., ditto preference 52s., River Plate 55⅜, South Metropolitan 82, 82¼, 82½, 83⅛, 83⅜, 83½, ditto 6⅜ p.c.t. debenture 104, South Suburban 88⅛, 88⅜, 90, ditto debenture 79½, Southampton 61½, Barnet 4 p.c.t. debenture 69, 69½. Hornsey 5 p.c.t. preference 77, 78, Liverpool 7 p.c.t. preference £30 paid 34, 34⅜, Richmond 5 p.c.t. 59½, Woking 10 p.c.t. "A" 60. On Thursday, British 28, 28⅛, Buenos Aires 54, 55, Commercial 3½ p.c.t. 81, Gas Light ordinary 79½, 79⅝, 80, 80¼, 80½, 80⅝, ditto maximum 59⅜, 59½, ditto preference 69½, 69¾, 70⅛, 71, Imperial Continental 149, 149½, 150, 150¼, 150⅜, 151, Primitiva 17s. 6d., 20s., 21s., ditto preference 57s. 6d., 58s., 58s. 9d., 59s., 59s. 4½d., 61s. 3d., ditto 1911 debenture 57, South Metropolitan 83, 83¼, 83⅜, Tottenham "B" 81, Wandsworth "B" 71, Liverpool 7 p.c.t. preference £30 paid 34⅛, 34⅜, Hornsey 5 p.c.t. preference 78, Pinner 7 p.c.t. "B" 5, 5⅛. On Friday, Alliance and Dublin 62½, Bombay 3⅜, British 28, 28⅛, Commercial 4 p.c.t. 80, 81, 82, ditto 3½ p.c.t. 79½, 80⅛, 81, ditto debenture 55, Gas Light ordinary 79, 79¼, 79⅜, 80, 80¼, ditto preference 71, ditto debenture 55, Imperial Continental 149, Liverpool 88½, Monte Video 57½, 60, 60½, Primitiva 20s., 21s. 3d., 22s., 22s. 6d., 22s. 9d., ditto preference 58s. 9d., 59s., 60s. 7½d., 61s., ditto debenture 75½, ditto 1911 debenture 56, South Metropolitan 83¼, 84¼, 84⅓, ditto debenture 55, 55½, South Suburban 89, ditto debenture 79½, 81, Tottenham "B" 84.

The Money Market was inclined to yield at the close. The Bank rate remains at 4½ p.c.t.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Shares.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	Name.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.s.					
182,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref.	...	40—55	...
1,551,868	,,	Oct. 13	2½	3 2/16%	Alliance & Dublin Ord.	59—64	60—65	62½
374,000	,,	Jan. 12	4	4%	Do. 4 p.c. Deb.	76—79	46—51	
280,000	5	Nov. 30	7½	4/-	Bombay, Ltd.	5⅛—6⅛	3⅛—4	3⅛—3⅜
100,000	5	Feb. 23	16	7½%	Bournemouth Gas and Water { 5 p.c.	...	9—10*	...
383,110	10	,,	7	7%	Bournemouth Gas and Water { B 7 p.c.	15—15½	8½—9*	...
115,000	10	,,	6	6%	Bournemouth Gas and Water { Pref. 6 p.c.	13⅛—14	7½—8*	...
162,065	—	Dec. 30	—	4%	Bournemouth Gas and Water { 4 p.c. Deb.	...	65—70	...
992,045	Stk.	Feb. 9	14	56/-	Brentford A Consolid.	261—266	84—89	85—86
734,920	,,	,,	11	55/-	Do. B New	204—209	84—89	84½—85
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	70—75	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb.	91—93	68—72	70
214,775	,,	Aug. 26	11	10½%	Brighton & Hove Orig.	208—213	145—150	148—150
244,200	,,	,,	8	7½%	Do. A Ord. Stk.	134—139	102—107	93½—99½
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	...
550,000	20	Sept. 29	12½	10%	British	44—45	27—29	27½—28½
120,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	68—72	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	52—57	54—55
100,000	10	May 27	—	6%	Cape Town & Dist., Ltd.	1⅛—2⅛	6—7	...
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4⅛—5⅛	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—61	...
137,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	79—84	78½—82
360,000	,,	,,	5⅛	38/4	Do. 3½ p.c. do.	103—105	77—82	78—81
475,000	,,	—	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	53—58	55
800,000	,,	Dec. 15	4	—	Continental Union Ltd.	76—79	18—20	18—20
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	33—38	...
51,600	,,	Feb. 23	15	15%	Croydon A 10 p.c.	...	185—195*	...
278,400	—	,,	12	12½%	Croydon B and C 7 p.c.	...	145—155*	...
492,470	Stk.	—	6	4½%	Derby Con. Stk.	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 26	10	5/0	European, Ltd.	17½—18	8⅛—9⅛	8⅛—9⅛
16,298,975	Stk.	Feb. 23	4/17/4	46/8	Gas Light and Coke { 4 p.c. Ord.	98—102	79—82*	78⅝—80⅜
2,600,000	,,	,,	3½	35/-	Gas Light and Coke { 3½ p.c. max.	76—79	57—60*	58⅛—59⅜
4,062,235	,,	,,	4	4%	Gas Light and Coke { 4 p.c. Con. Pref.	96—99	70—73*	69—71
4,674,850	,,	Dec. 15	5	5%	Gas Light and Coke { 5 p.c. Con. Deb.	72½—74½	53—58	55—55½
130,000	,,	Dec. 11	10	10%	Gas Light and Coke { 10 p.c. Bonds.	...	...	...
82,500	,,	Sept. 14	5	3½%	Hastings & St. L. 5 p.c.	...	...	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	87—89	45—55	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16⅞	5⅛—6⅛	...
86,600	Stk.	Aug. 26	9	9%	Hornsey 7 p.c.	...	100—105	...
131,000	,,	July 28	7½	7½%	Ilford A and C	151—154	110—120	...
65,780	,,	,,	6½	3½%	Do. B	115—118	96—101	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	60—65	...
1,976,000	,,	Oct. 28	9	5%	Imperial Continental	150—160	147—152	148—152
1,235,000	,,	Feb. 9	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	67—72	...
235,942	,,	Aug 20	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	77—82	79—80
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A.	211—213	...	88½
					Liverpool 5 p.c. Ord. { B.	146—148	...	...
306,085	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Feb. 23	7/3/6	6%	Maidstone 5 p.c.	...	53—55*	...
63,480	,,	Dec. 30	—	5%	Do. 5 p.c. Deb.	...	43—46	...
75,000	5	June 11	6	5%	Malta & Mediterranean	4⅛—4½	2—2½	...
250,000	100	Oct. 3	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	93—100	...
541,920	Stk.	Nov. 30	4	4%	Monte Video, Ltd.	11⅛—12	57—62	57½—60½
1,875,892	,,	Feb. 23	4½	4½%	Newcastle & Gatsh'd Con.	98½—99½	72½—73½*	...
539,705	,,	Dec. 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	61—65½	64½
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	...	12½—13	...
55,940	10	,,	7/14/0	5/3	,, ,, 7 p.c.	14—15	9—10	...
300,000	Stk.	Dec. 15	8	8%	Oriental, Ltd.	117—122	84—87	85½—85⅝
60,000	5	—	10	—	Ottoman, Ltd.	7½—7⅞	2—3	...
188,120	Stk.	Dec. 30	—	6%	Plym'th & Stonch'se 5 p.c.	...	69—71	...
60,000	50	Aug. 26	13	60/-	Portsea Island, B	128—132	74—77	...
100,000	50	,,	12	55/-	Do. C	118—121	51—54	...
249,980	5	—	8	—	Primitiva Ord.	5⅛—6	1—1½	14/—21/-
499,960	5	—	5	—	Do. 5 p.c. Pref.	4⅜—5	2½—3⅛	46/3—61/3
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	91—93	74—76	75½
600,000	Stk.	Jan. 26	4	4%	Do. ,, ,, 1911	...	52—57	56—57
346,198	,,	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	52—57	55½
150,000	10	Sept. 29	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	6—6½	...
125,000	50	Jan. 3	5	5%	San Paulo { 5 p.c. Deb.	47—49	36—39	...
135,000	Stk.	Aug. 26	10	5%	Sheffield A	223—224	70—72	...
209,984	,,	,,	10	5%	Do. B	222—224	70—72	...
523,500	,,	,,	10	4½%	Do. C	220—222	70—72	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Oct. 28	9	8%	South African	10½—11½	7—9	...
6,609,895	Stk.	Feb. 9	5/4/0	5%	South Met. Ord.	111—113	83—85	82½—84½
250,000	,,	Jan. 12	—	5%	Do. Red. Pref.	...	94—96	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72½—74½	53—58	55—55½
224,820	,,	Feb. 23	8½	8½%	South Shields Con. Stk.	137—139	99—101*	...
1,087,795	,,	,,	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	87—92*	88½—90
368,837	,,	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	78—83	79½
647,740	,,	Nov. 16	5	4%	Southampton Ord.	99—102	59—62	59—61½
121,275	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	...	60—62	...
120,000	,,	Feb 23	—	7½%	Tottenham { A 5 p.c.	135—138	88—93*	...
782,275	,,	,,	6	5½%	Tottenham { B 3½ p.c.	115—117	78—83*	81—84
181,255	,,	Dec. 15	4	4%	District { 4 p.c. Deb.	87—89	68—72	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
886,476	Stk.	Aug. 26	5	5½%	Tynemouth 5 p.c. max.	108½—109	67—69	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Aug. 11	8½	66/3	Wandsworth A 5 p.c.	151—156	84—86	...
855,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	68—71	71
108,075	,,	,,	—	46/4½	Do. C	...	65—67	...
140,865	,,	,,	—	46/4½	New Ordinary	...	65—67	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c.	117—122	65—67	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c.	121—126	63—67	...
88,416	,,	Dec. 30	3	3%	5 p.c. Deb. Stk.	66—69	50—55	...

* Ex Div.

Ministry of Health Inquiry at Llandudno.—Mr. F. Gregson Williams, of the Ministry of Health, held an inquiry at Llandudno on the 3rd inst. into an application by the Urban District Council for sanction to borrow £9921, being the sum in excess of the loan secured for the purification plant and reconstruction of the gas-works last year at a cost of over £50,000; and also for power to raise a shorter term loan of £11,000, being the extra cost of coal during the strike. A ratepayer opposed the application on the ground that the gas charge—6s. 6d. per 1000 c.ft.—was excessive. Mr. F. Duxbury (the Gas Manager) said that, owing to the increased sale of gas, the reduced cost of coal, and economies at the works, he hoped the undertaking would be in a much more favourable position this time next year.

Newmarket Gas Company.—It was reported at the annual meeting of the Company that the accounts for the twelve months ended Dec. 31 showed a deficit on the year's trading of £677—largely accounted for by the coal strike and the continued high price of all gas-works requisites. In 1914 the cost of labour was £1867, and last year £4982; while coal cost £5329 in the former year and £14,876 in 1921. The price of gas was advanced at July 1 from 5s. 2d. to 6s. 6d. per 1000 c.ft., in order to meet the greatly increased manufacturing costs; and the average price charged for the year was 5s. 10d. The Chairman (Mr. Robert Stephenson, J.P., D.L.) said that fortunately the Company had been able during normal times to build-up a reserve; and they proposed now to take out of their reserve fund sufficient to pay a dividend of 5 p.ct. for the past year. In the previous year, which was also a bad one, they made a profit of £2713; and in 1912 their profit was £5115. Their direct loss, of which 80 p.ct. fell on the consumers, was something like £2500 owing to the strike alone. However, they were looking forward to a decidedly better year so far as sales of gas were concerned, and to very shortly being able to pay their pre-war dividend. He had not much doubt that the price of gas would be reduced during the current year. Mr. J. H. Troughton (the Manager and Secretary) gave a vivid account of his experiences during the strike, and emphasized the fact that they had supplied the public at a heavy loss.

Tully Gas Plants, Ltd., of Millgate, Newark-on-Trent, have been successful in obtaining orders for their gas plants for Louhans and St. Germain—both in France.

Harrogate Gas Company.—The accounts for the year ended Dec. 31 indicated, said the Directors in their report, that the period covered by them had been one of financial adjustments. The profits shown by revenue account were nominal. There was, however, a balance on net revenue account of £16,635 available for dividend. The amount payable thereout for the half year to satisfy the statutory dividends would reduce it to £13,212. By the authority of the Harrogate Gas Act, 1921, there had been appropriated out of the net revenue balance as on Dec. 31, 1920, £3423 to the special purposes fund, and £2298 to the reserve fund, bringing those funds up to the full amounts authorized under the previous Acts. The balance standing to the credit of net revenue account as on Dec. 31 last, in so far as it exceeded one year's dividend on the consolidated and preference stock, was required by the Act to be applied in rebates to gas consumers. Owing to the increase in the cost of manufacture due to the coal strike, estimated at £20,000, and to the appropriations referred to, the amount available for consumers would only be £579. They had, however, greatly benefited by the price of gas only having been increased temporarily, so as to avoid a loss on the year. The policy of the Board was to bring the financial position at once into accord with the provisions of the new Act. At the conclusion of the annual meeting an extraordinary meeting of the Company was held, at which the proprietors were asked to authorize the raising, as required, of additional capital up to £100,000.

An interim dividend for the year ending June 30 next of 20s. per share (less income-tax) will be paid on the ordinary shares of the British Gas Light Company, Ltd., on April 7.

Orders have been received by the Turbine Furnace Company, Ltd., from the Hastings and St. Leonards Gas Company and the Bridgend Gas and Water Company for patent "Turbine" furnaces, with indestructible fire-bars, and suitable for burning coke breeze successfully in steam raising.

A fused electric wire is believed to have been responsible for a considerable fire recently at the wallpaper warehouse of Messrs. Morris & Co., Leeds, in the course of which sparks fell into the carpenters' shop of the adjoining Grand Theatre. The warehouse and stock were extensively damaged; but the promptitude of the fire brigade prevented the fire spreading to the theatre.

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CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70 & 72, Chancery Lane, London, W.C. 2.
Telegrams: "Patent, London." Phone 243 Holborn,
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

MOORE'S GAS GENERATOR SYNDICATE, LTD.

COMBINED, AND SELF CONTAINED WATER AND COAL GAS PLANT.

CAPACITY, 100,000 c.ft. to 1,000,000 c.ft. per day.

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ENQUIRIES SOLICITED.

FOR Gas Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.
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TAR AND GAS LIQUOR WANTED IN LONDON DISTRICT.

THOMAS CLAYTON (Oldbury), Ltd., BRENTFORD, W.
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TAR WANTED.

BEFORE entering into any arrangement for the DISPOSAL of your Production it will be to your interest to communicate with
BROWNHILLS CHEMICAL WORKS CO., near WALSALL.

WE are Buyers of Crude Gas-Works COAL TAR. If you have any for DISPOSAL, kindly communicate with
CONSTABLE, HART, AND CO., LTD., TAR MACADAM MANUFACTURERS, MATLOCK

J. E. C. LORD (Manchester), Ltd., Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR (SATURATORS), LTD., Chemical Plant Engineers, Blackhorse Street Mills, BOLTON.
Telegrams—"SATURATORS, BOLTON." Telephone 848.

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 60 years. Reference given to Gas Companies.

INVENTIONS PATENTED. TRADE MARKS REGISTERED.
Advice and Handbook free. 35 years' references. Gas Patents a Speciality. KING'S PATENT AGENCY, Ltd. (Director, B. T. King, A.I.M.E., British and U.S. Regd. Patent Agent), 146A, QUEEN VICTORIA STREET, LONDON, E.C. 4.

NATIONAL ASSOCIATION OF TECHNICAL GAS OFFICIALS.

Head Office:—Temple Courts, 55, Temple Row, BIRMINGHAM.

Full particulars for membership, &c., can be obtained from the General Secretary.

APPOINTMENTS, &c., WANTED.

CONSULTING Gas Engineer with Wide Experience, making monthly visits to the Midlands and North of England and South of Scotland, has Time to devote, in an ADVISORY CAPACITY, to any Gas Undertaking.
Address, No. 7113, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

EXPERT Gas Engineer. Thirty Years' Experience in Alterations to Plant and ADVISING GAS COMPANIES IN OBTAINING BEST RESULTS. Overhead Charges most reasonable.
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APPOINTMENTS, &c., VACANT.

WHEN Filling Vacancies, please REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualifications being equal, has the FIRST CALL ON YOUR CONSIDERATION.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

APPLICANTS are Thanked and Informed that the Position of ASSISTANT to MANAGER is NOW FILLED.

URBAN DISTRICT COUNCIL OF NEWRY.
(GAS DEPARTMENT.)

APPOINTMENT OF CONSULTING ENGINEER.

THE Gas Committee of the above Council require the Services of a COMPETENT GAS ENGINEER to ADVISE THEM, as and when required, on all matters relating to the gas undertaking, including the Repairing and Improving of the Existing Plant and the Installing of new Plant.
The Engineer appointed will be required to visit the gas-works once annually, in the month of May, for the purpose of making a Thorough Examination of the Entire Plant and reporting to the Committee on the gas undertaking generally, with a view to maintaining same in proper working condition, and to supply a working statement, also a comparative statement of the cost of Maintenance, Manufacture, and Distribution of Gas. He will also be required to advise from time to time as to the existing methods of Manufacturing and Distributing Gas and the Production and Treatment of Residuals, with a view to effecting improvements and having the undertaking conducted on the most up-to-date lines.
Applicants to state Qualifications, References, and Terms, and to name a fee for additional visits if desired by the Committee.
Applications to be addressed to The Chairman of the Gas Committee, Town Hall, Newry, and delivered not later than the 29th instant.
Dated this the 8th day of March, 1922.
By order,
THOMAS WATT, Secretary.
Gas Offices,
Kilmorey Street,
Newry.

DRAUGHTSMAN required for Drawing and Estimating Offices of Large Firm of Constructional Engineers in the Midlands. Experience in Gas-Works Plant a recommendation.
Apply, by letter, stating Experience and Salary required, to No. 7146, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

METER and Street Lighting Firm, with Good Connection in Scotland, require a REPRESENTATIVE for the Northern District. Preference given to One residing in Edinburgh or other big city.
Apply, by letter, to No. 7130, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

WELL-KNOWN Firm of Gas and Heating Engineers requires First-Class COMMISSION AGENT for Scotland. One with good Connection among Shipbuilders, Foundries, Engineering Works, and Gas-Works preferred.
Apply meantime, with full Particulars and, if possible, with References, to No. 7148, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

PLANT, &c., FOR SALE & WANTED

FIRTH BLAKELEY, SONS, & CO., Ltd., Church Fenton, Leeds, have the following Plant to offer:
BEDS of 6's and 8's 22 by 15 ☐ 6 in. Pipes. Cheap before removal. Could refix or Tender including Retorts and Settings.
GASHOLDERS—300,000, 172,000, 115,000, 50,000, 30,000, 20,000, and Two 5000 capacity.
"HOLMES" & "KIRKHAM" WASHER-SCRUBBERS, 10 in., 12 in., and 14 in. Connections.
"LIVESEY" WASHERS, 12 in. & 8 in. Connections.
CONDENSERS. Annular Set of 8 with 20 in. Connections, new inner tubes, ready for delivery. Water Tube Condenser 20,000 per hour, 15 in. Connections.
CONDENSERS. Sets of 4 Annular, 8 in. & 12 in. Connections. Sets of 6 in. & 9 in. Vertical Pipe.
EXHAUSTERS and ENGINES. Waller's & Donkin's from 50,000 to 2000 capacity per hour, Steam, Gas, and Belt driven, overhauled.
TOWER SCRUBBERS, 5 ft. by 40 ft., 4 ft. 6 in., by 36 ft., 4 ft. by 20 ft., 3 ft. by 13 ft.
PURIFIERS. Sets of 6 ft., 8 ft., 12 ft., and 25 ft. square, delivered and erected.
STATION METERS and GOVERNORS. 40,000 to 2000 per hour, complete.
Every Requisite for Gas-Works supplied. We undertake Delivery and Erection Complete and solicit inquiries.
DISMANTLING SPECIALISTS. Surplus and obsolete Plant purchased. Best prices paid. Removal by expert staff.
FIRTH BLAKELEY, SONS, & Co., LTD., CHURCH FENTON, *via* LEEDS.

H.M. FACTORY.
DORNOCH CAMP, GRETNA.
£5,000,000 TO £10,000,000 DEAL IN GOVERMENT SURPLUS STORES.

HENRY BUTCHER & CO. have received Instructions from MESSRS. ROWNSON DREW, AND CLYDESDALE, LTD., to SELL by AUCTION, WITHOUT RESERVE, on Tuesday, March 28, 1922, and Two Following Days, at Eleven o'clock each day, the Highly Important and Valuable
NEW AND PARTLY-USED STORES,
comprising approximately 400 Tons IRON and M.S. FLATS, ROUNDS, SHEETS, GIRDERS, &c., 100 Tons ASSTD. BOLTS, NUTS, and WASHERS, 50 Tons RIVETS, 20 Tons ASSTD. NAILS, 10 Tons tested CHAIN, 10 Tons iron and strand WIRE, 3 tons H.S. tool steel, 3 tons tin'd steel sheets,
500 TONS STEAM TUBES AND FITTINGS
(1 in. to 8 in.), 4 Tons ASBESTOS and other packing, 2 tons sheet rubber packing, 1 Ton ASBESTOS CLOTH, 250 HOFFMAN and other BALL BEARINGS, 3000 gauge glasses, 30 cwt. rope belting, 5000 Ft. BALATA and other BELTING, 6000 Ft. I.R. SUCTION and DELIVERY HOSE (¼ in. to 3 in.), 500 PULLEY BLOCKS, 20 5-ton differential ditto, 300 C.I. and Wrot. PULLEYS, 50 Hydraulic and other JACKS, 2000 Gross ASSTD. BRASS and IRON SCREWS, cotter pins, glacie line, NAVVY BARROWS, sack and scoop WEIGHING MACHINES, 200 Galls. LUBRICATING and OTHER OILS, 20 Tons PAINT, RED LEAD, BITUMEN, DISINFECTANT, SOAP, 100 parallel Vices, 100 sets Stocks and Dies, together with large quantities of TOOLS for all trades, Builders' and Contractors' Material, Engineers' Stores and Equipment, &c.
On view seven days preceding the sale.
Catalogues (when ready) and all particulars from Messrs. ROWNSON, DREW, and CLYDESDALE, Ltd., 225, UPPER THAMES STREET, LONDON, E.C. 4 ('phone, Central 1070, 10 lines) (telegrams, Rownson, Cent., London); Messrs. HENRY BUTCHER and Co., Engineers and Metal Trades Valuers, Surveyors, and Auctioneers, 63 and 64, CHANCERY LANE, LONDON, W.C. 2. Phone, Holborn 741. Telegrams, Penetrancy, Holb., London.

GUILDFORD GAS LIGHT AND COKE COMPANY.

THE above Company have for Sale a GASHOLDER TANK, 52 ft. diameter, with a capacity of 250,000 Gallons; also GUIDE FRAMING and COLUMNS of a Gasholder of 120,000 c.ft. capacity.
Offers are invited for the purchase of above, which can be viewed on the Company's Works, and further particulars can be obtained from Mr. P. C. Cleasby, Engineer and Manager, Gas-Works, Guildford.
WILLIAM TITLEY, F.C.I.S., Secretary.
Gas Offices,
Onslow Street,
Guildford.
March 7, 1922.

AMMONIA Stills (Three) Vertical Type, Good Second-Hand, FOR SALE. Capacity, approximately 30 Tons of Liquor per Twenty-four hours per Still.
Full Particulars on Application to the CARGO FLEET IRON COMPANY, LTD. (Purchasing Department), MIDDLESBROUGH.

RAILWAY Tank Wagons for Disposal, Rectangular and Cylindrical, specially suitable for Oil, Inflammable Liquids, also Acids.
Inquiries invited.
BROTHERTON & Co., LTD., LEEDS.

STEAM-BOILERS—All Sizes, Vertical, Loco-type, Cornish, Portable, and Other Types of Boilers.
Apply GRANTHAM BOILER & CRANK CO., LTD., GRANTHAM.

TAR PLANT Wanted (Second-Hand), Still output about 140 Tons per week, complete with Primary Still, Condensers, Separators, Settling Tanks, or would consider portion.
State Price, full Particulars, and where seen (must be in Good Condition) to No. 7147, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

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